TAYLOR YARD MULTIPLE OBJECTIVE FEASIBILITY STUDY

DRAFT REPORT

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ACRONYMS AND ABBREVIATIONS

AB411	California State Assembly Bill 411, "Right to Know" Bill
AIA	American Institute of Architects
AQMD	South Coast Air Quality Management District
bgs	below ground surface
BMPs	Best Management Practices
BOD	Biochemical Oxygen Demand
BOE	Board of Equalization
Cal/EPA	California Environmental Protection Agency
CDHS	California Department of Health Services
CDTS	California Department of Toxic Substances
CDWR	California Department of Water Resources
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CMP	Corrugated Metal Pipe
CNPS	California Native Plant Society
COD	Chemical Oxygen Demand
COPC	Contaminants of Potential Concern
CSS	Coastal Sage Scrub
DHS	California Department of Health Services
DNAPL	dense non-aqueous phase liquids
DTSC	California EPA Department of Toxic Substances Control
DWR	Department of Water Resources
E	Endangered, as in Table 2.2
EDR	Environmental Data Resources, Inc.
ERM	Environmental Resources Management
ERT	Environmental Research and Technologies
EVS	EVS Environment Consultants, Inc.
FoLAR	Friends of the Los Angeles River
GAC	Liquid-Phase Granulated Activated Carbon
GWR	Groundwater Recharge
HP	High Pressure

IC	Industrial Compliance Incorporated
IND	Industrial Service Supply
IWPP	Industrial Waste Pre-treatment Plant
l	liters
LACDPW	Los Angeles County Department of Public Works
LADPW	City of Los Angeles Department Public Works
LADWP	City of Los Angeles Department of Water and Power
LAR	Los Angeles River
LARWQCB	Los Angeles Regional Water Quality Control Board
MBE	Miller Brooks Environmental, Inc.
MCL	Maximum Concentration Level
ml	milliliters
MOWD	Southern Pacific Transportation Company Maintenance of Way Department
MPN	Maximum Probable Number
MTA	Los Angeles County Metropolitan Transportation Authority
MUN	Municipal and Domestic Supply
MWDSC	Metropolitan Water District of Southern California
NEPA	National Environmental Protection Agency
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NURP	Nationwide Urban Runoff Program
PAHs	polycyclic aromatic hydrocarbons
ppm	parts per million
PRG	Preliminary Remediation Goals
PRPs	Potential Responsible Parties
PWA	Philip Williams Associates Ltd.
RBF	Robert Bein, William Frost and Associates, Inc.
RCB	Reinforced Concrete Box Culvert
RCP	Reinforced Concrete Pipe
RCRA	Resource Conservation and Recovery Act (1976), administered by USEPA Office of Solid Waste
REC-1	Water Contact Recreation
REC-2	Non-Contact Water Recreation

RI/FS	Remedial Investigation/Feasibility Study
SCC	California State Coastal Conservancy
SCE	Southern California Edison Company
SFV	San Fernando Valley
SFVGWB	San Fernando Valley Groundwater Basin
SLERA	Screening level ecological risk assessment
SPTCo	Southern Pacific Transportation Company
SSC	Species of Special Concern
STP	Sewage Treatment Plant
SVOC	Semi-volatile Organic Compound
SWRCB	California State Water Resources Control Board
T	Threatened, as used in Table 2.2
TPH	Total Petroleum Hydrocarbon
TTLC	Total threshold limit concentrations
ULARA	Upper Los Angeles River Area
UPRC	Union Pacific Railroad Company
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USGS NPWRC	Northern Prairie Wildlife Research Center
VOC	Volatile Organic Compound
WARM	Warm Freshwater Habitat
WET	Wetland Habitat
WILD	Wildlife Habitat
μg	microgram

1. INTRODUCTION

1.1 BACKGROUND

Taylor Yard is an active railroad maintenance facility located on the eastern bank of the Los Angeles River (LAR) in the City of Los Angeles (City), California as shown in Figure 1.1. The site is bounded on the west by the LAR, north by the Glendale Freeway, south by the Los Angeles County Metropolitan Transportation Authority (MTA) property (Parcel C), and east by San Fernando Avenue. The site comprises a total of approximately 244 acres.

Taylor Yard has been used for railroad-related maintenance operations since the early 1880's. The site was used for maintenance of locomotives, refrigeration cars, rail car storage, rail car switching, and equipment storage (Figure 1.2). Utility shops were located on the property to provide electrical, plumbing, and mechanical support services. In 1996, the Union Pacific Railroad Company (UPRC) purchased the property from the Southern Pacific Transportation Company. The Active Yard, which occupies approximately 61.2 acres, is the only parcel currently used for railroad maintenance operations. UPRC is responsible for the current operations. The Active Yard (Parcel G) and surrounding parcels are shown on Figure 1.3.

In 1986, the U.S. Army Corps of Engineers (USACE) and Los Angeles County Department of Public Works (LACDPW) considered using Taylor Yard as a flood storage facility as part of the plan formulation phase of a feasibility study aimed at improving flood control along the LAR (USACE, 1992). Initial analyses indicated that conversion of Taylor Yard to a detention basin would provide significant flood protection improvements only through downtown Los Angeles; however, flood protection improvements were needed in the lower reaches of the LAR. Therefore, creation of a flood detention basin at Taylor Yard was eliminated from further USACE studies.

Taylor Yard received renewed attention during the City's greenbelt corridor feasibility study (City, 1990) and from the USACE Watercourse Improvement Study (USACE, 1993). Both of these studies identified Taylor Yard as having potential value for habitat restoration and recreational facility creation in addition to flood storage improvement. In 1993, Robert Bein, William Frost and Associates, Inc. (RBF) conducted a study (Multi-Use Study) for the Friends of the Los Angeles River (FoLAR) and LACDPW (RBF, 1993).

The results of the Multi-Use Study, which were summarized in a report prepared by RBF titled, "Multi-Use Study on the Los Angeles River at Taylor Yard," indicated that a multi-objective project featuring flood storage, recreational facilities, and habitat restoration was feasible from an engineering and environmental standpoint. Three alternative designs were developed based on terraced configurations featuring flood storage and habitat restoration on the lowest terrace adjacent to the LAR, flood storage and passive recreation on the middle terrace, and active recreation/urban development on the highest terrace, which was located farthest from the riverbed. A preferred alternative was selected from the three conceptual designs and the estimated project cost was approximately $214 million, which

Figure 1.1 - Project Location

Figure 1.2 - Southern Pacific Railroad Historical Use Areas

Figure 1.3 - Existing Parcel Layout

consisted of $125 million for land acquisition and $89 million for construction. The study noted the presence of soil and groundwater contamination but concluded that contamination would probably not pose a constraint on habitat restoration options so soil excavation and disposal costs were based primarily on uncontaminated soil. The results of the study, which focused heavily on hydrology, hydraulics, and engineering, revealed that it probably would be feasible to construct a side weir structure to divert flows from the LAR into the flood storage and restored habitat area. The results also indicated that it would probably not be practical to remove a portion of the flood control levee due to river channel expansion and contraction space requirements.

Since completion of the Multi-Use Study, there have been several land use changes and development projects completed within Taylor Yard as shown on Figure 1.4. The MTA and UPRC constructed an embankment and railroad line through the middle of the site (Parcel A). Parcel D was remediated for soil contamination. A Federal Express service center was built on Parcel E. MTA constructed a maintenance facility on the southern portion of the site (Parcel C). Legacy Development developed the area north of Parcel E for light industrial uses on what is Parcel F. The net result of these activities is that the area of Taylor Yard available for implementation of a multiple-objective study has shrunk from about 174 acres in 1993 to approximately 101.7 acres on Parcel D and Parcel G (Active Yard).

In 1998, the California State Coastal Conservancy (SCC) authorized the use of $250,000 of Proposition 204 funds to conduct a feasibility study of potential multiple objective options for Taylor Yard. The SCC released a Request For Services (RFS) in March 2000 to conduct a multiple objective study of the Active Yard. In June 2000, the SCC selected a team of professional consultants to undertake the feasibility study. The study was divided into two phases with Phase 1 focusing on an analysis of existing conditions and the development of multiple-objective project alternatives and Phase 2 focusing on preliminary engineering studies for a preferred alternative.

1.2 PURPOSE

As stated in the RFS, the goal of the study summarized in this report was to investigate possible flood management, habitat enhancement, parks, and recreational opportunities on 61 acres currently designated as railroad operating and maintenance facilities.

1.3 OBJECTIVES

The objectives of the study identified to achieve the purpose summarized above are presented below.

1. Review the historical development and existing conditions of the site.

Figure 1.4 - New Features Since 1993 Workshop

2. Identify the major opportunities and constraints related to habitat restoration of the Active Parcel.
3. Develop alternatives that provide a mixture of habitat types, recreational opportunities, and flood storage improvement.
4. Evaluate the environmental impacts and regulatory requirements for implementation of the alternatives.
5. Estimate the construction cost for each alternative.
6. Determine the number of restoration/flood storage improvement projects similar to Taylor Yard that would be needed to obtain a significant improvement in flood storage along the Los Angeles River.
7. Prepare recommendations for the Phase 2 study.

1.4 STUDY TEAM

The Taylor Yard Feasibility Study Team (Team) was led by Everest International Consultants, Inc. (EIC). EIC was responsible for project management, water quality, sedimentation, and engineering for the multidisciplinary project team. Miller Brooks Environmental, Inc. (Miller Brooks) conducted a preliminary investigation of the onsite contaminants and developed potential remediation measures for contaminants of potential concern. Hydrology, hydraulics, biology, and ecology issues were addressed by WaterCycle LLC (WaterCycle) with additional biological support provided by Daniel S. Cooper. Philip Williams & Associates Ltd. (PWA) conducted hydrodynamic modeling of the LAR to verify the hydrologic regime for each alternative and to assess the impact of each alternative on flood control. Architram Design Group, Inc. (Architram) was responsible for community/urban planning and KTU+A provided landscape architecture and graphics support services for the Team.

2. EXISTING CONDITIONS

2.1 SITE LOCATION

Taylor Yard is located in Los Angeles, California (Figure 1.1). The property is bounded to the west by the LAR, east by San Fernando Road, north by the Glendale Freeway, and south by the Interstate 5 Freeway (I-5). Taylor Yard consists of approximately 244 acres of land. The site historically consisted of one large parcel that was subsequently divided into ten parcels designated Parcels A, B, C, D, E, F, G, H, I, and J (Figure 1.3). Most of the parcels have been or will be developed for industrial uses with only Parcels D and G available for development as open space, recreation, or flood storage improvement. Parcel G, also known as the Active Yard, occupies approximately 61.2 acres of the property.

The site is situated on the eastern boundary of the LAR within a reach of the river known as the Glendale Narrows (Narrows), between the San Fernando Valley (SFV) and Los Angeles Coastal Plain. The Narrows portion of the river is a steep-sided valley approximately five miles in length, located on the southeast portion of the SFV, between the Elysian Hills and Santa Monica Mountains to the west and the Repetto Hills to the east (Metropolitan Water District of Southern California [MWDSC], 1987).

Taylor Yard is located on the U.S. Department of the Interior, Geological Survey (USGS) Topographic Map (7.5-minute series) for the Los Angeles Quadrangle dated 1966 and photo revised in 1981. Elevations at Taylor Yard range from approximately 335 feet above mean sea level (MSL) at the south end to 380 feet MSL at the north end, with a general topographic gradient to the west. The Active Yard has an average elevation of 355 feet MSL.

2.2 LAND USE

Taylor Yard and the area surrounding the parcels analyzed in this study, belong to the communities of Northeast Los Angeles and Silver Lake-Echo Park. The uses immediately surrounding Taylor Yard are industrial with a transition to non-industrial uses such as retail, office, and residential. Immediately abutting the industrial area adjacent to Taylor Yard are the long-established neighborhoods of Cypress Park, Glassell Park, Elysian Valley, and Atwater Village.

The land east of San Fernando Road is zoned for commercial and residential development as shown in Figure 2.1. The existing land uses do not have any kind of physical or functional connection with Taylor Yard, except for the proximity of two major thoroughfares, San Fernando Road and the MTA/UPRC railroad that runs through the center of the site. There is also the more remote presence and visual connections with the Glendale (2) Freeway and the interchange between the Pasadena (I-110) and Golden State (I-5) Freeways.

Figure 2.1 - Existing Land Use Designations

The Active Yard (Parcel G) and Parcels A, B, and C are used for rail operations and maintenance. Federal Express operates a shipping facility on Parcel E and Parcel F is being developed for light industrial activities. Parcels H and J were developed for industrial use with the Nelson Nameplate facility constructed on Parcel H. All these parcels are currently zoned for industrial use.

2.3 HYDROLOGY

The hydrologic regime of Taylor Yard and surrounding area consists of direct precipitation, LAR flows, local runoff, and groundwater flowing under the site (Figure 2.2). These sources could be used individually or in combination to restore various types of habitat at Taylor Yard under various restoration alternatives. Each source of water is described in more detail in this chapter.

2.3.1 Precipitation

Direct precipitation in this area of the Los Angeles Basin is typical of other near-coastal areas of semi-arid Southern California. The hydrologic climate is characterized by a wet season that extends from November to March and a dry season that extends from April to October. Almost all of the precipitation falls during the wet season and the area may go without any rain from April to October. The monthly precipitation from 1921 to 2000 is shown below in Table 2.1.

Table 2.1 – Los Angeles Civic Center Station Monthly Precipitation (1921 to 2000)

Month	Precipitation (inches)		
	Minimum	Average	Maximum
Jan	0	3.06	14.94
Feb	0	3.26	13.68
Mar	0	2.51	8.37
Apr	0	1.16	9.93
May	0	0.25	3.57
Jun	0	0.07	1.12
Jul	0	0.01	0.18
Aug	0	0.07	2.26
Sep	0	0.28	5.67
Oct	0	0.38	2.37
Nov	0	1.38	9.68
Dec	0	2.35	8.48

Source NWS, 2002

Figure 2.2 - Water Sources

2.3.2 Los Angeles River

The LAR drains a watershed that covers 834 square miles. While only a portion of this runoff passes the southwest boundary of Taylor Yard, the adjacent section of the LAR conveys flood flows, urban runoff, and treated wastewater effluent from the northern reaches of Los Angeles to the Pacific Ocean at Long Beach. Historically, the river flowed continuously through this section fed by groundwater that was forced up by relatively shallow, impermeable geologic strata underlying this portion of the LAR (Gumprecht 1999). However, during the early part of the 1900's the City of Los Angeles Department of Water and Power (LADWP) implemented an extensive water extraction program throughout the San Fernando Valley that lowered the groundwater level upstream of the Glendale Narrows area effectively eliminating the dry season water that naturally flowed through the LAR (Gumprecht 1999).

In the 1980's, dry season flows returned to the LAR fed by wastewater treatment effluent from the Tillman and Glendale Sewage Treatment Plants (STPs) and local urban runoff. These water sources continue to provide flows to the LAR throughout the year and provide the base flow during the dry season. As a result, riparian vegetation and associated wildlife have increased throughout the LAR, enhancing the habitat that was impacted through implementation of flood control measures. The increase in stream vegetation has also increased the flood control maintenance effort (USACE, 1992) required to clear the LAR of debris, vegetation, and sediment that may decrease the ability of the channel to convey flood flows quickly to the ocean.

The hydrology of the LAR has two distinct regimes. The dry season regime of the LAR is characterized by limited storm runoff associated with summer thunderstorms that sometimes occur in the coastal mountains, treated wastewater effluent, and urban runoff. The river flows produced from these sources are relatively small comprising a base flow that rarely rises above the bottom of the river channel. The wet season regime of the LAR is characterized by storm runoff that varies in magnitude depending on the magnitude of the storm and antecedent moisture conditions. The river flows produced from storm events vary substantially, sometimes producing little change over base flow conditions during relatively dry years. At other times, tropical storm cells create torrential river flows that may achieve flow velocities in excess of 20 miles per hour (mph), carrying large volumes of water, sediment, and debris (e.g., logs, shopping carts, and cars). Most of the time during the wet season, the water level in the LAR is a few feet above the channel bottom , however flows associated with extreme storm events (e.g. 100-year event) can cause the water level to rise to just below the levee top (i.e. approximately 21 feet above the channel bottom. Since the completion of the channel construction in 1956, the LAR has not exceeded its channel capacity. However, within the soft-bottom reach that includes Taylor Yard, there is now an extensive growth of trees and shrubs that have greatly increased the roughness of the channel, thereby decreasing the discharge capacity of the LAR flood control system.

2.3.3 Local Runoff

Runoff from areas outside Taylor Yard, including the surrounding neighborhoods of Glassell Park, Cypress Park, and Mt. Washington, is directed into storm drains running under Taylor Yard. These storm drains empty into the LAR through culverts along the northeastern flood control levee. The railroad embankment isolates the site from runoff generated by adjacent parcels within Taylor Yard. Runoff from the LAR flood control levee is directed to the LAR, since the site elevation is at the same level or higher than the levee crest.

2.3.4 Groundwater

Groundwater flows beneath Taylor Yard continuously throughout the year. The alluvial soils underlying the site are comprised of sands and gravels that allow relatively high groundwater flows due to the porous nature of the soils. Although present throughout the year, the groundwater elevation varies significantly through the seasons with high groundwater levels during the wet season and low levels during the dry season. The historical annual fluctuation in groundwater level is illustrated in Figure 2.3. The locations of the wells are shown in Figure 2.4. The relatively large drawdown for Wells W-8 and W-11 shown in Figure 2.3, may be attributable to pumping associated with the Pollock Wellfield that was brought into service in March 1999 (ERM, 2000b).

Taylor Yard is located within the San Fernando Valley Groundwater Basin (SFVGWB) within the Upper Los Angeles River Area (ULARA). The ULARA encompasses all the watershed of the LAR and its tributaries above a point in the river designated as LACDPW Gauging Station F-57C-R, near the junction of the LAR and the Arroyo Seco, just to the south of Taylor Yard. Groundwater in the Narrows occurs under unconfined conditions, with a regional gradient to the southeast. Significant groundwater is present beneath Taylor Yard, primarily in the Gaspur Aquifer, which is located at the base of the recent sediments (DWR, 1961; City of Los Angeles vs. City of San Fernando et al, 2000).

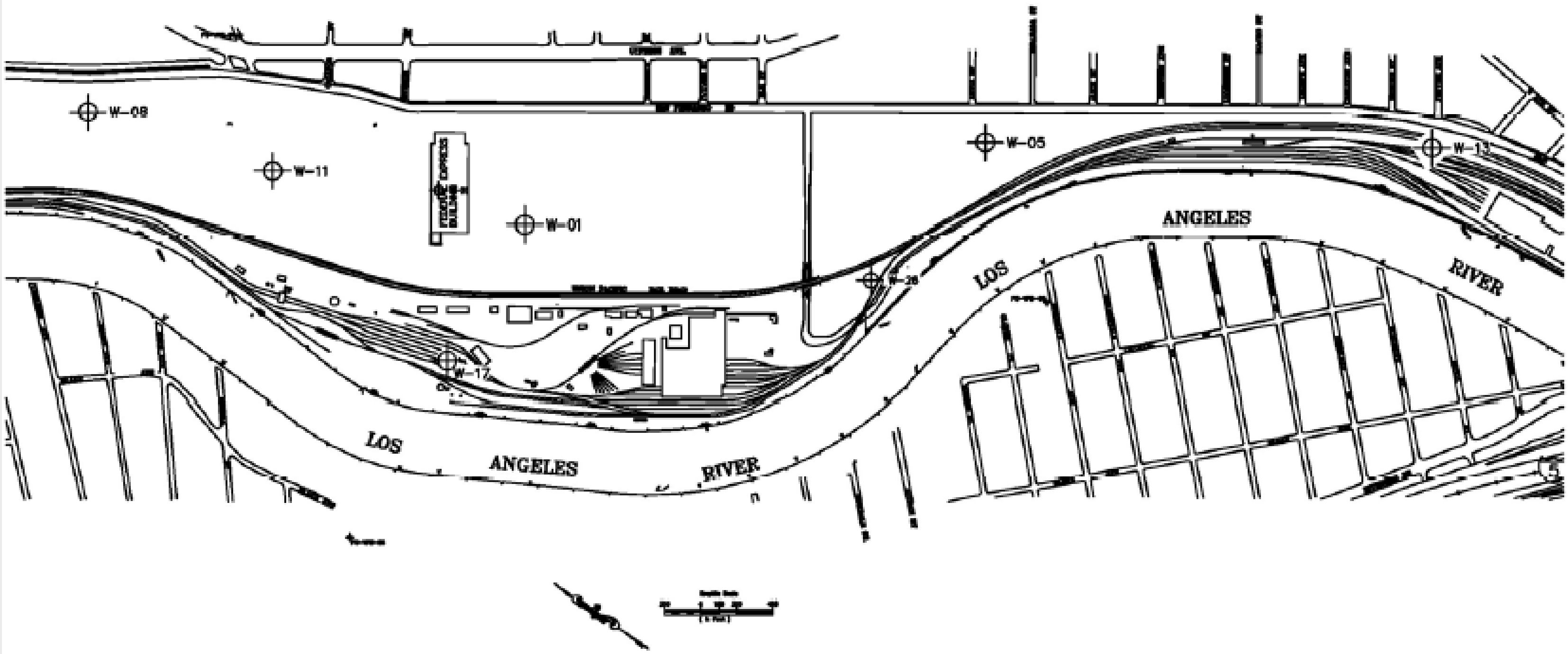
The SFVGWB consists of the eastern portion of the San Fernando Valley (SFV) and the entire Verdugo Basin. The Basin encompasses approximately 112,000 acres of alluvial valley fill deposits and provides enough water to serve approximately 600,000 people (City of Los Angeles vs. City of San Fernando et al, 2000). The USEPA San Fernando Valley study area includes four National Priority List (NPL) sites. The NPL is a published list of hazardous waste sites in the country that are eligible for extensive, long-term cleanup under the Superfund program (USEPA, 2001). These sites are as follows: Area 1 North Hollywood, Area 2 Crystal Springs, Area 3 Verdugo, and Area 4 Pollock. Taylor Yard is within Area 4, which covers approximately 5,829 acres in the southeastern part of the SFV and is located in and adjacent to the cities of Los Angeles and Glendale.

Groundwater contamination in the SFVGWB is linked to historical and current industrialization in the San Fernando Valley. The contaminants of potential concern are volatile organic compounds (VOCs), including chlorinated hydrocarbons and associated products. These chlorinated hydrocarbons or solvents are used by many industries in the valley and have found their way into the groundwater through improper use, storage, and disposal practices. The SFVGWB Superfund sites were added to the NPL in 1986 and contain areas where concentrations of VOCs in groundwater are above water standards. In some of the wells, the groundwater contamination is so severe that the wells have been decommissioned (EDR, 2001).

The LADWP Pollock Wells Treatment Plant was placed into service in March of 1999. The facility is located in the Narrows area and restores the use of two Pollock production wells by treating the groundwater with Liquid-Phase Granular Activated Carbon (GAC). The

Figure 2.3 - Historical Annual Fluctuation of Groundwater Level (including influence of Pollock Wellfield)

Figure 2.4 – Locations of Groundwater Monitoring Wells



CALIFORNIA STATE COASTAL CONSERVANCY **TAYLOR YARD** **WETLAND RESTORATION STUDY**	EVEREST **EVEREST INTERNATIONAL CONSULTANTS, INC.** 444 W. OCEAN BLVD., SUITE 1104 LONG BEACH, CA 90802 TEL (562) 435-9305 FAX (562) 435-9310	APPROVED:	SCALE: AS SHOWN	DATE: 1/5/01
		DESIGNED: CHECKED:	PROJECT NO. 0017	SHEET:

treatment process removes VOCs from the groundwater, then the groundwater is chlorinated and blended with imported water to reduce nitrate concentrations. The focus is to prevent the migration of contaminated groundwater into the LAR. By restoring the use of the Pollock wells, groundwater levels in a localized area near the LAR are reduced and groundwater discharges to the river are virtually eliminated (City of Los Angeles vs. City of San Fernando et al, 2000).

A factor affecting hydrologic conditions in the Narrows has been the increasing releases of reclaimed waters. These large year-round releases tend to keep the alluvium of the Narrows area full, even in dry years. There is the opportunity for percolation in the unlined reach of the LAR, both upstream and downstream of the paved section near the junction of the LAR and the Verdugo Wash (City of Los Angeles vs. City of San Fernando et al, 2000).

Based on data collected in 1999 and 2000, the general groundwater flow direction beneath Taylor Yard is to the south-southeast with an average hydraulic gradient across the entire yard of 0.0021 foot per foot (ft/ft). Groundwater in the Active Yard is found at depths between 20 feet below ground surface (bgs) and 35 feet bgs (Environmental Resource Management [ERM], 2000b).

2.4 BIOLOGY

From a biological standpoint, Taylor Yard supports fragmented ruderal habitat that has been heavily disturbed by railroad operation and maintenance activities. The human impacts caused by building construction, grading, and railroad operations include habitat destruction, wildlife displacement, hydrologic modification, soil contamination, and water quality degradation. These impacts have dramatically impacted the habitat and associated wildlife in this upland area. The existing biological conditions on Parcel G, Parcel D, and in the adjacent reach of the LAR are described below. Existing vegetation is given in.

2.4.1 Parcel G

Parcel G is covered with non-native species such as Washington palms (*Washingtonia filifera, W. robusta*), ox-tongue daisy (*Picris echinoids*), and fountain grass (*Pennisetum setaceum*) that provide little habitat for wildlife. However, the open land does support a wintering bird community that has been almost extirpated elsewhere in the Los Angeles Basin, including grassland species like Loggerhead Shrike (*Lanius ludovicianus*) and Western Meadowlark (*Sturnella neglecta)*. Should this grassland habitat be restored and disturbance reduced, it is likely that additional sensitive species such as the Northern Harrier (*Circus cyaneus)* would utilize the area as well.

2.4.2 Parcel D

Parcel D is highly disturbed, crisscrossed with roads, and dominated by introduced species. These introduced species include grasses, herbs, and trees, most of which are highly invasive. Invasive grasses and herbs have created a mosaic of small patches in the areas that have been repeatedly disturbed. Grass species include Ripgut Grass (*Bromus*

Figure 2.5 - Existing Vegetation

diandrus), foxtail chess (*B. madritensis* ssp*. rubens*), slender wild oats (*Avena barbata*), and fountain grass . Herbaceous species include mustard (*Hirschfeldia incana*), Russian thistle (*Salsola tragus*), and star-thistle (*Centaurea melitensis*). Tree tobacco (*Nicotiana glauca*) and castor bean (*Ricinus communis*) are occasionally present. However, both produce prodigious amounts of seed and are beginning to gain a foothold. Gum tree (*Eucalyptus* sp.) provides some vertical structure. The few trees present here are approximately 40 feet tall.

Trash is also present in the area, ranging from tires and couches to construction debris and regular household trash. However, in spite of a first impression suggesting an area occupied exclusively by non-native species and trash, Parcel D supports a surprising number of native species. Native species that occur here occasionally include blue elderberry (*Sambucus mexicana*), broad-leaved cattails (*Typha latifolia*), toyon (*Heteromeles arbutifolia*), California black walnut (*Juglans californica*), and willow (*Salix* spp.). Several Fremont cottonwoods (*Populus fremontii*) add structure to the otherwise scrub and grassland habitats. Tree heights are approximately 20 feet to 25 feet. Mule fat (*Baccharis salicifolia)* occurs in an almost solid stand but intergrades into a stand of the invasive fennel (*Foeniculum vulgare*). Coastal sage scrub associates occur in a long dense stand next to the road at the western boundary. These species include laurel sumac (*Malosma laurina*), coyote brush (*Baccharis pilularis*), California buckwheat (*Eriogonum fasciculatum*), California sagebrush (*Artemisia californica*), and black sage (*Salvia mellifera*).

2.4.3 Los Angeles River

Located in the soft-bottomed Glendale Narrows, the portion of the LAR next to Taylor Yard consists of relatively extensive riparian and freshwater marsh habitat. This channel reach is next to one of the largest patches of undeveloped land adjacent to the river downstream of the Sepulveda Basin. A survey conducted upstream of Los Feliz in 1986 found a variety of vegetation on sand bars within the river channel (USACE 1993). The vegetation included willows, sycamores, cottonwood, box elders, Arizona ash (*Fraxinus arizonica)*, eucalyptus, Giant Reed (*Arundo donax)*, Castor bean, exotic ornamentals, cattails, bulrush (*Scirpus Americana)*, and other aquatic plants. Many species of migrant songbirds utilize the riverbed, particularly Lincoln's Sparrow (*Melospiza lincolnii*) and Yellow Warbler (*Dendroica petechia*) during spring and autumn, and waterfowl and waders, such as Black-crowned Night-Heron (*Nycticorax nycticorax)*, Green Heron (*Butorides striatus)*, and Bufflehead (*Bucephala albeola*) during winter. This is one of the few locales for rails (*Rallus limicola*) in urban Los Angeles.

In summer, several riparian birds can be found nesting along this stretch, including Red-shouldered Hawk (*Buteo lineatus*), Common Yellowthroat (*Geothlypis trichas)*, and Blue Grosbeak (*Guiraca caerulea)*. The cold artesian wells in this stretch provide a ready source of water for native fishes including Arroyo Chub (*Gila orcutti*), which has been observed in the Sepulveda Basin just upstream from Taylor Yard. Western Toad (*Bufo Boreas*) and Pacific Tree-Frog (*Hyla regilla*) also persist in the river channel.

The year round flows of the LAR in this reach support nearly continuous riparian vegetation with areas of open water habitat and sandbars. Native species present in the channel are predominantly willows, including arroyo willow (*Salix lasiolepis*), and narrow-leaf willow (*S. exigua*). Other native species occasionally present included mule fat, Fremont cottonwood, western sycamore (*Plantanus racemosa*), and broad-leaved cattails. The vegetation is mostly shrubby with tree species ranging up to 50 feet. Together, this vegetation can be described as mixed willow series (Sawyer and Keeler-Wolf 1995), or cottonwood-willow riparian forest (Holland 1986). Visual estimates for percent cover for native species ranges from 30 percent to 40 percent.

Exotic flora (e.g., *Arundo*, Shamel Ash (*Fraxinus x.*), and palms) are found extensively within the river channel. These species pose a significant threat to the native riparian plant and animal species. Giant reed dominates the exotic species with a percent cover estimated at approximately 40 percent. Other exotic species present include castor bean, cocklebur (*Xanthium strumarium*), white sweetclover (*Melilotus albus*), willow weed (*Epilobium adenocaulon*), and nightshade (*Solanum americanum*). Further studies, including a site visit would be needed to provide estimates of percent cover for each species as well as habitat extent and structure.

Table 2.2 - Sensitive and/or Localized Birds of the Lower Los Angeles River

Bird Species	Breeding status*	Legal Status
Least Bittern	1	SSC (CA)
American Bittern	0	
Great Blue Heron (nesting only)	2	SSC (CA)
Green Heron (nesting only)	3	
Common Moorhen (nesting only)	1	
Northern Harrier	0	SSC (CA)
Cooper's Hawk (nesting only)	4	SSC (CA)
White-tailed Kite	1	
California Quail	1	
Western Screech-Owl	4	
Lesser Nighthawk	1	
Costa's Hummingbird	1	
Greater Roadrunner	1	
Downy Woodpecker (nesting only)	4	
Belted Kingfisher (nesting only)	1	
Tree Swallow (nesting only)	0	
Warbling Vireo (nesting only)	0	
Bell's Vireo	2	E (US, CA)

Table 2.2 Cont.

Bird Species	Breeding status*	Legal Status
Cactus Wren	1	SSC
Marsh Wren	2	
California Gnatcatcher	1	T (US)
Wrentit	1	
Swainson's Thrush (nesting only)	1	
California Thrasher	1	
Loggerhead Shrike	1	
Yellow Warbler (nesting only)	2	SSC (CA)
Yellow-breasted Chat	2	SSC (CA)
Common Yellowthroat (nesting only)	3	
Black-headed Grosbeak (nesting only)	4	
Blue Grosbeak	3	
Song Sparrow	4	
Spotted Towhee	2	
Tricolored Blackbird	4	SSC (CA)
Western Meadowlark	0	
American Goldfinch	4	

* Legend to Abbreviations:

4 = Various habitats, including urban parks and neighborhoods
3 = Soft-bottomed portions of rivers
2 = Flood control basins only
1 = Highly localized
0 = Currently extirpated as a breeder

T = Threatened
SSC = Species of Special Concern
E = Endangered

Source: Garrett and Dunn 1981; Garrett 1993; Allen and Garrett 1995; Gallagher 1997; USGS NPWRC 2000; Compiled by D.S. Cooper, 2000.

Table 2.3 - Bird Species probably extirpated, except as transients

Bird Species	Legal Status *
Sandhill Crane	T (CA)
White-faced Ibis	SSC (CA)
Black Rail	T (CA)
Golden Eagle	SSC (CA)
Ferruginous Hawk	SSC (CA)
Swainson's Hawk	T (CA)
Bald Eagle	E (CA), T (US)
Long-eared Owl	SSC (CA)
Burrowing Owl	
Yellow-billed Cuckoo	E (CA)
Hairy Woodpecker	
Horned Lark	
Willow Flycatcher	E (US)
Bank Swallow	T (CA)
Purple Martin	SSC (CA)
Wilson's Warbler	
Bell's Sage Sparrow	SSC (CA)
Yellow-headed Blackbird	SSC (CA)

* Legend to Abbreviations:

T = Threatened
SSC = Species of Special Concern
E = Endangered

Source: Garrett and Dunn 1981; Garrett 1993; Allen and Garrett 1995; Gallagher 1997; USGS NPWRC 2000; Compiled by D.S. Cooper, 2000.

2.5 GEOLOGY

The Glendale Narrows consists of an alluvium-filled valley resulting from the erosion of surrounding hills and alluvial fans and the subsequent deposition of these sediments by the ancestral LAR. The water-bearing alluvium within the Narrows is Quaternary in age and is underlain by non-water bearing bedrock of Tertiary age. Soil overlying bedrock in the Narrows consists primarily of highly permeable sand and gravel with a maximum thickness of approximately 160 feet. Structural features in the vicinity include the Raymond Fault, which transects the Narrows 0.75 miles northwest of Taylor Yard, and the Elysian Park Anticline crossing the southernmost portion of the yard (CDWR, 1961).

Results of environmental investigations conducted at Taylor Yard to date (ERM, 2000, ERT 1987) indicate that subsurface soils in the Active Yard generally consist of fill material extending from the ground surface to a depth of approximately 7 feet bgs as well as sands and silty sands with minor discontinuous clayey sands extending from 7 feet bgs to 35 feet bgs. These sediments are underlain by gravelly sand and generally coarse-grained sediments from 35 to 44 feet bgs. Below 55 feet bgs, the coarse sand and gravel content increases with depth to 100 feet bgs, which was the maximum depth of investigations reviewed for this study. Cobble layers of varying thickness are also found below 55 feet. Clay or silt zones of less than 5 feet in thickness were observed between 60 feet bgs and 70 feet bgs (ERM, 2000a).

2.6 WATER QUALITY

This chapter discusses the quality of existing water sources that could be used for habitat restoration of Taylor Yard based on a review of available data. The water sources include dry season LAR flows, wet season LAR storm flows, local runoff, and groundwater.

2.6.1 Los Angeles River

2.6.1.1 Beneficial Uses

The following existing and potential beneficial uses were designated by the Los Angeles Regional Water Quality Control Board (LARWQCB) for the surface water in the section of the LAR near Taylor Yard (LARWQCB, 1996).

- Existing Water Contact Recreation (REC-1)
- Existing Non-Contact Water Recreation (REC-2)
- Existing Warm Freshwater Habitat (WARM)
- Existing Wildlife Habitat (WILD)
- Existing Wetland Habitat (WET)
- Existing Groundwater Recharge (GWR)
- Municipal and Domestic Supply (MUN)
- Industrial Service Supply (IND)

2.6.1.2 Water Quality Objectives

Applicable water quality objectives, standards, and guidelines for the protection of the designated beneficial uses for the surface water in the LAR near Taylor Yard include the following:

- Los Angeles Region Water Quality Control Plan Objectives (Basin Plan) (LARWQCB, 1994)
- California Toxic Rule Objectives (USEPA, 2000)
- AB411 Indicator Bacteria Standards (CDHS, 2000)

These objectives have been applied in combination to conduct surface water quality evaluations in the Los Angeles Region (LACDPW, 2000).

2.6.1.3 Wet Season Conditions

The LACDPW determined the contaminants of potential concern in the LAR that may impair the designated beneficial uses under wet season conditions (LACDPW, 2000). The determination was based on the exceedence of the aforementioned three sets of water quality objectives by the annual mean or median concentrations of constituents during the monitoring period of 1994-2000 (LACDPW, 2000). Table 2.4 lists the constituents and associated measured concentration levels compared to the applicable objectives and/or standards.

2.6.1.4 Dry Season Conditions

The contaminants of potential concern under dry season conditions in the LAR near Taylor Yard were identified based on data from a long-term dry season monitoring gage at Arroyo Seco (LACDPW, 1994). Additional data obtained from the LARWQCB (2001), which contain historical monthly and/or occasional sampling data from stations at Los Feliz Boulevard and the Pasadena Freeway as well as Arroyo Seco, were also analyzed. Contaminants of potential concern frequently measured at non-compliance levels included bacteria, ammonium, chloride, sulfate, nitrate-N, nitrite-N, and lead. Table 2.5 lists the contaminants of potential concern and associated measured concentration levels compared with the applicable objectives and standards.

Table 2.4 - Wet Season Contaminants of Potential Concern

Constituent of Concern	Unit	Mean Concentration[1]	Basin Plan Objective[2]	California Toxic Rule Objective (Freshwater)[3, 4]	AB411 Objective[5,6]
Cyanide	μg/l	10[7]	-	5.2	-
Total Coliform	MPN[11]/100 ml	2,213,291	70[8]	-	10,000
Fecal Coliform	MPN/100ml	1,477,645	200[8]	-	400
Fecal Enterococcus	MPN/100ml	358,468	-	-	104
Aluminum	μg/l	1,122[10]	1,000[9]	-	-
Cadmium	μg/l	3.3[7, 10]	-	2.2	-
Copper	μg/l	32[10]	-	9	-
Lead	μg/l	53[10]	-	2.5	-
Zinc	μg/l	152[10]	-	120	-

1. Source:
2. Source: LA-RWQCB, 1994
3. Source: USEPA, 2000
4. Continuous concentration
5. Source: CDHS, 2000
6. Instantaneous concentration
7. Annual mean for the year of non-compliance
8. 30-day mean concentration
9. Source: LACDPW, 1994
10. Dissolved concentration
11. MPN (Maximum Probable Number)

Table 2.5 - Dry Season Contaminants of Potential Concern

Constituent Of Concern	Unit	Concentration Mean/Max[1]	Basin Plan Objective[2,3]	California Toxic Rule Objective (freshwater)[4]	AB411 Objective[5]
Total Coliform	MPN/100ml	10,858/11,000	70	-	10,000
Fecal Coliform	MPN/100ml	2,247/24,000	200	-	400
Fecal Enterococcus	MPN/100ml	788/9,000	-	-	104
Ammonium	mg/l	10.1/36.3	17.9-19.4[6]	-	-
Chloride	mg/l	128/226	150		
Sulfate	mg/l	183/370	300		
Nitrate-N	mg/l	6.0/17.6	10		
Nitrite-N	mg/l	1.1/8.7	1		
Total Dissolved Solids	mg/l	669/972	950	-	-
Lead	µg/l	8/140	-	2.5	-

1. Source: LACDPW, 1994
2. Source: LA-RWQCB, 1994
3. For areas represented by the LACDPW Arroyo Seco monitoring station (Station 17) (LACDPW, 1994).
4. Source: USEPA, 2000
5. Source: CDHS, 2000
6. Based on Temperature of 10-20° C and Typical LAR pH of 7. Function of temperature and pH in general.

2.6.2 Local Runoff

A preliminary estimate of offsite pollutant loading to Taylor Yard was made using the LACDPW watershed land use-based monitoring data (LACDPW, 2000) that characterizes the mass emissions of constituents from specific land uses. Land uses in the drainage areas surrounding Taylor Yard consist of industrial, residential, and commercial uses (AIA, 1992). Table 2.6 shows the mean concentrations of constituents typically important to wetlands in storm water runoff from the three land uses in Los Angeles County (LACDPW, 2000). Concentrations of the same constituents from the median and 90th percentile urban sites monitored under the Nationwide Urban Runoff Program (NURP) also are listed for comparison. The NURP levels are recommended by USEPA (1983) for use in planning-level runoff quality analysis in cases where local data are not available.

Table 2.6 - Water Quality of Local Runoff Based on NURP Database

Constituent	Unit	Concentration	
		Los Angeles[1]	NURP (Median/90th% Sites)[2]
BOD[3]	mg/L	22	9/15
COD[4]	mg/L	81	65/140
Total Suspended Solids	mg/L	120	100/300
Total Phosphorous	mg/L	0.35	0.33/0.70
Total Kieldahl Nitrogen	mg/L	3.0	1.5/3.3
Nitrite+Nitrate-N	mg/L	0.76	0.68/1.75
Total Copper	μg/L	30	34/93
Total Lead	μg/L	15	144/350
Total Zinc	μg/L	361	160/500

1. Source: LACDPW, 2000
2. Source: USEPA, 1993
3. BOD, Biochemical Oxygen Demand
4. COD, Chemical Oxygen Demand

Comparison with the NURP levels indicates that, except for BOD, the constituent levels in the local runoff from a typical mixed industrial/commercial/residential area in Los Angeles County are similar to those from a median urban site monitored by the USEPA. The data suggest that the constituents in the storm runoff from areas surrounding Taylor Yard could be at moderate levels compared with typical urban sites monitored by the USEPA. The BOD level, however, could be a contaminant of potential concern in terms of the water quality for wetlands restoration at Taylor Yard. The estimate above was based on the countywide mean values; therefore, the results may change based on site-specific runoff sampling.

2.6.3 Groundwater

Taylor Yard is located within the San Fernando Valley Groundwater Basin (SFVGWB). Groundwater in the Glendale Narrows section of the groundwater basin occurs under unconfined conditions, with a regional gradient toward the southeast in the general direction of the LAR. Groundwater exists at depths between 20 feet bgs and 35 feet bgs (ERM, 2000b). However, infiltration water has been encountered at depths of less than 5 feet bgs within the Service Track and Diesel Shop areas of the site.

Beneficial uses of the groundwater in the vicinity of Taylor Yard include three LADWP municipal water supply wells located up gradient from the site. Monitoring activities at the site have shown groundwater contamination with VOCs at levels exceeding state drinking water standards or Maximum Contamination Levels (MCLs) (MBE, 2001, ERM, 2000b).

2.7 SOIL AND GROUNDWATER CONTAMINATION

A desktop investigation was conducted to identify the issues and associated implications related to soil and groundwater contamination on Parcel G. Over 20 documents prepared by DTSC and various environmental consultants (i.e. ERM, ERT, IC) were reviewed and the information was interpreted to provide a summary of the issues related to onsite contamination. The focus of the effort was to define potential issues related to the geographic extent of contamination (lateral and vertical), regulatory process associated with contaminant remediation, and implications of soil and groundwater contamination on multiple-objective alternative development.

2.7.1 Historical Contaminant Use

Taylor Yard has been used as a rail yard since the 1890s. Activities on the property have included locomotive and refrigeration car maintenance and washing, diesel service and maintenance, fueling, car storage and switching, equipment storage, and the operation of utility department shops for electrical, mechanical, and plumbing works. Generally, past chemical usage at Taylor Yard included acids, paint, waste oil, gasoline, and chlorinated solvents (ERM, 2000a). The use of acids, paints, solvents, and petroleum products has resulted in soil and groundwater pollution associated with the following types of contaminants.

- Total Petroleum Hydrocarbons (TPH)
- Volatile Organic Compounds (VOCs)
- Semi-Volatile Organic Compounds (SVOCs)
- Heavy Metals (Metals)

2.7.2 Regulatory Framework

Groundwater contamination in the SFVGWB is linked to prewar, postwar, and current industrialization in the valley. The primary contaminants of potential concern are VOCs (primarily trichloroethylene [TCE] and tetrachloroethylene [PCE]) that were used in the aeronautical manufacturing, automotive manufacturing, automotive repair, metal scraping/plating, and dry cleaning industries. The solvents migrated into the groundwater as a result of improper use, storage, and disposal practices. Environmental agencies have been conducting investigations and cleanup of the groundwater in the SFVGWB since contamination was discovered in 1979. The SFVGWB was designated a Superfund site in 1986 when groundwater from wells was found to contain VOCs above the state and federal drinking water standards. The SFVGWB was divided into four areas (from north to south): Area 1 - North Hollywood, Area 2 - Crystal Springs, Area 3 - Verdugo, and Area 4 - Pollock. Area 4 begins at the northern end of Taylor Yard and extends to the southern most limit of the yard (EDR, 2001).

The site-specific investigation on Taylor Yard was initiated in 1990 as a five-phase Remedial Investigation/Feasibility Study (RI/FS) in accordance with the requirements of the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control's (DTSC) Enforceable Agreement (Docket #HSA89-90-006). The Enforceable Agreement allowed the separation of Taylor Yard into two areas: Sale Parcel (Parcels A, B, C, D, E, F) and Active Yard (Parcel G), for the purposes of the RI/FS (Terranext, 1996). Regulatory remediation of the Sale Parcel was achieved in March 1998 so no additional review was conducted by MBE for the Sale Parcel. The RI/FS to determine remediation measures for human land uses (e.g., industrial, commercial, residential) of the Active Yard is ongoing. The five phases of the RI/FS are listed below, along with the current status of each phase.

- Phase 1 - Initiation of Groundwater Monitoring (completed)
- Phase 2A - Quarterly Groundwater Monitoring (ongoing)
- Phase 2B - Vapor Probe Survey (completed)
- Phase 3 - Soil and Groundwater Investigation (completed)
- Phase 4 - Soil and Groundwater Data Gaps Investigation (completed)
- Phase 5 - Modeling and Risk Assessment Data Collection (ongoing)

2.7.3 Active Yard Remedial Investigation/Feasibility Study

The majority of the past soil and groundwater remediation work conducted on Parcel G was part of the five-phase RI/FS that is summarized below.

The Phase 1 portion of the RI/FS consisted of (1) installation of four new groundwater monitoring wells; (2) sampling of the four new wells concurrent with sampling of 19 existing wells; and (3) monthly groundwater elevation monitoring. Samples were collected and analyzed for total petroleum hydrocarbons (TPH) such as diesel, as well as VOCs. No concentrations of TPH were detected in the wells. Five VOCs were detected in samples collected from various wells at concentrations exceeding the MCLs (Terranext, 1996).

Phase 2 of the Active Yard RI/FS was divided into two subphases: Phase 2A and Phase 2B. Phase 2A consisted of quarterly groundwater monitoring that was initiated in November 1994. The program currently consists of quarterly sampling for VOCs, PAHs, and some metals. Phase 2B consisted of a vapor probe survey within the Active Yard. The results of the survey revealed vapor concentrations of various VOCs greater than 10 micrograms per liter (ug/l) (Terranext, 1996).

Phase 3, which consisted of soil and groundwater sampling, was conducted in 1997 and 1998. The sampling included 53 soil borings to a maximum depth of 30 feet bgs and sampling of 12 new groundwater wells. The soil and groundwater samples were analyzed for TPH, VOCs, SVOCs, and metals. Concentrations of chemicals detected in soil were compared to the USEPA Preliminary Remediation Goals (PRGs) for residential soil, which are risk-based criteria for evaluating contaminated soil. The concentrations of chemicals in the groundwater samples were compared to the maximum concentration levels (MCLs). The results revealed VOC and SVOC levels in soil exceeding the PRGs in some areas of the site. TPH levels ranged from 20 part per million (ppm) to 40,000 ppm. The concentrations of the metals antimony, arsenic, beryllium, lead, and chromium (total) were found to exceed the PRGs at depths from 0.5 feet bgs to 30 feet bgs. The results of the groundwater sampling indicated the presence of VOCs at concentrations exceeding the MCLs throughout the Active Yard. SVOCs were detected but no MCLs were available for the detected compounds.

Phase 4 was conducted from June 1998 through February 1999. Soil samples were collected to determine the extent of contaminants and soil-vapor extraction wells were installed to evaluate the potential for VOC removal. Soil-vapor extraction was found to be an effective measure for remediation of VOCs at Taylor Yard. Vertical profiling of contamination indicated that VOCs above the regulatory limits exist at depths between 40 feet bgs and 100 feet bgs. The results of Phase 4 revealed no correlation between VOC-impacted soil and VOC-impacted groundwater. It was concluded that the VOCs in groundwater underneath Taylor Yard are, in part, from offsite sources (ERM, 2000a).

The Phase 5 work plan was submitted to the DTSC in March 2000 (ERM, 2000c). The work plan was developed to address remaining soil and groundwater data gaps. The investigation will include soil sampling and groundwater monitoring for onsite and offsite migration.

2.7.4 Groundwater Monitoring

In October 1994, a groundwater monitoring program was implemented at Taylor Yard in accordance with the requirements of the DTSC Enforceable Agreement (Docket #HSA89-90-006). There are currently 30 onsite and 3 offsite wells included in the monitoring program, with 22 wells on Parcel G. The analytical results of the groundwater monitoring events showed no detected concentrations of TPHs. Some VOCs were detected at levels above MCLs. Chlorinated solvent concentrations in excess of the MCLs were encountered in groundwater beneath some areas in the Active Yard (ERM, 2000b). Heavy metals and trace elements were detected in wells on the Active Yard during the groundwater sampling conducted between 1999 and 2000. The results are summarized in Table 2.7.

Table 2.7 - Concentration of Metals Detected in Groundwater Samples[1]

Metal	Concentration (ppb[2])	MCL (ppb)
Arsenic	1.11 - 4.04	50
Barium	48.8 - 254	1,000
Cadmium	1.17 - 5.96	5.0
Chromium	1.08 - 12.9	50
Cobalt	1.13 - 30.7	NL[3]
Copper	1.47 - 60.7	NL
Lead	1.12 - 4.45	NL
Molybdenum	1.34 - 30.0	NL
Nickel	2.62 - 84.1	100
Selenium	1.37 - 15.6	50
Vanadium	2.35 to 9.93	NL
Zinc	10.1 to 43.4	NL

1. MBE, 2001
2. ppb, Parts Per Billion
3. NL, Not Listed

2.7.5 Summary of Findings

2.7.5.1 Soil Contamination

The main contaminants of potential concern on Parcel G are petroleum hydrocarbons, VOCs, SVOCs, and metals. The reports reviewed stated that the entire upper 10 feet of soil underlying Parcel G was contaminated with petroleum hydrocarbons. Figure 2.6 shows the contaminants exceeding screening criteria levels. Due to the porous nature of the soil, extensive vertical transport of soluble chemicals (predominantly chlorinated solvents and other VOCs) has occurred over time resulting in contamination of these chemicals to depths of at least 100 feet bgs. Soluble metals and other contaminants also may be present at depths of 100 feet bgs; however, no sampling was reported in the documents reviewed for these constituents as part of the site investigation. Less soluble chemicals (SVOCs and nonsoluble metals) tend to have the highest soil concentrations 5 feet bgs to 10 feet bgs.

Part of the soil remediation currently proposed for the Active Yard will consist of soil vapor extraction to remove VOCs in the unsaturated soil above groundwater (i.e., vadose zone). This activity is currently being conducted to reduce the potential for existing VOC soil

Figure 2.6 - Contaminants Exceeding Screening Criteria Levels

contamination to provide a future source of groundwater contamination for areas beneath the Active Yard. Remediation measures for SVOCs, chlorinated solvents, and heavy metals will be established after completion of the five-phase RI/FS.

The purpose of the sampling and analyses conducted under the RI/FS and other remediation programs implemented for the Taylor Yard property was to determine cleanup responsibilities and develop remediation measures to make the property safe for human uses. These human uses would include industrial, commercial, and residential development and associated activities. Under these land uses the primary contaminant receptor would be humans and the major exposure pathways would be drinking contaminated water, ingesting airborne contaminated soil (e.g., fugitive dust during construction), and direct contact with contaminated soil.

Habitat restoration and associated wildlife usage was not identified as a potential land use for the RI/FS that is currently underway. Since wildlife are susceptible to different contaminants than humans and to different concentrations of the same contaminants as humans, the sampling and analyses needed to determine remediation levels for habitat restoration are different than for human uses. Therefore, the level of ecological risk to the wildlife that would use restored habitat at Taylor Yard is currently unknown. An ecological risk assessment would have to be conducted to determine the potential risk to the target wildlife and develop remediation measures to minimize the risk to wildlife. An ecological risk assessment would provide the information needed to address the following three questions related to soil contamination.

- Can the target wildlife be exposed to the existing soil without substantial risk?
- If the existing soil poses a substantial risk to the target wildlife can it be remediated to levels suitable for the target wildlife?
- If the soil can be remediated to levels suitable for the target wildlife, what methods should be used to achieve the cleanup goals and how much will it cost?

2.7.5.2 Groundwater Contamination

Due to the location of Taylor Yard at the southern end of the SFVGWB Superfund Sites, cleanup of the groundwater will be problematic because of potential offsite contaminant sources. For example, of the four areas within the SFVGWB designated in 1986, active remediation has been initiated only in the North Hollywood site (Area 1). The LADWP is conducting the RI/FS of the SFVGWB with USEPA oversight. The investigation has been divided into two phases, with Phase 1 including installation of over 80 monitoring wells and Phase 2 consisting of a basin wide remedial investigation. In September 1987, groundwater extraction and treatment with an air stripper was selected for the North Hollywood Area as an interim remedy. This remedial action was constructed with funding from the USEPA and the state has been treating groundwater at a rate of 12,000 gallons per minute since 1989. Negotiations are continuing with Potential Responsible Parties (PRPs) for recouping the cost of the design, construction, and operation of this system. In June 1993, groundwater extraction and treatment was designated as the interim remedy in the Crystal Springs Area (Area 2). The USEPA and the state are currently negotiating with the PRPs to recover the cost of oversight. Non-settling PRPs are in litigation with USEPA for cost recovery.

Currently, no remedial actions have been identified for the Verdugo Area (Area 3), but the USEPA and LARWQCB are identifying potential sources of contamination and pursuing PRPs.

In specific reference to Taylor Yard, the LADWP Pollock Wells Treatment Plant was placed into service in the Pollock Area (Area 4) in March 1999. The facility is located at the northern end of Taylor Yard in the Narrows area and restores the use of two existing production wells by treating the extracted groundwater with activated carbon. The carbon removes VOCs from the groundwater and the treated water is then chlorinated and blended with imported supplies to reduce nitrate concentrations. The focus is to prevent the migration of contaminated groundwater into the LAR. By restoring the use of the Pollock wells, groundwater levels in a localized area near the LAR are reduced and groundwater discharges to the river are virtually eliminated (City of Los Angeles vs. City of San Fernando et al, 2000).

A complicating factor affecting hydrologic conditions in the Narrows has been the increasing releases of reclaimed waters. Releases from the Glendale Sewage Treatment Plant and Tillman Sewage Treatment Plant were started in 1976-77 and 1985-86, respectively. These large year-round releases tend to keep the alluvium of the Narrows area full, even in dry years. There is the opportunity for percolation in the unlined reach of the river, both upstream and downstream of the lined section near the junction of the LAR and Verdugo Wash. Water percolating in the unlined reach is believed to circulate through shallow zones and reappear as rising groundwater downstream from Taylor Yard. In addition, up to 3,000 acre-feet of recharged water delivered from water within the Narrows-Pollock Wellfield area adds to rising groundwater conditions (City of Los Angeles vs. City of San Fernando et al, 2000).

The USEPA will not pursue a remedial investigation in the Pollock Area as it has been determined that the groundwater extraction system being implemented by the LADWP in the Pollock field to contain the groundwater plume will be an adequate interim remedial measure. The USEPA and RWQCB are identifying potential sources of contamination and pursuing PRPs. As the PRPs are identified, individual site investigations and remediation activities will be pursued (EDR, 2001).

In summary, the groundwater contamination beneath the Active Yard is part of a regional problem that is currently being addressed by the USEPA and RWQCB. The process will require the identification of PRPs, development of remedial measures, allocation of costs, implementation of remedial measures, and continual monitoring. At Taylor Yard, the regional contamination problem is complicated due to the onsite contribution from rail yard activities as well as offsite contribution from nearby sources. The cleanup process will be part of a basin wide effort that will take decades to complete.

2.8 INFRASTRUCTURE

There are several significant components of infrastructure located throughout the project site. The site is used for transportation, utilities, storm flow conveyance, and flood protection. The various infrastructure components within or near the project site are shown in Figure 2.7 and are described below.

2.8.1 Utilities

The utilities presented below pass through Taylor Yard and protection or realignment must be considered in alternative development.

2.8.1.1 Electric Transmission Lines

Overhead power transmission lines run along the northern levee of the LAR in the Taylor Yard area. The power transmission lines are supported by steel-frame towers on the northern levee with spacing approximately 600 to 800 feet apart. These lines are the property of the LADWP.

2.8.1.2 Telecommunications Lines

Several telecommunication lines run along the southwest side of the active rail line parallel to the northeast border of Parcel G. These lines include a U.S. Sprint Fiber System which consists of a bundle of four 2-inch PVC conduits, one of which is vacant, and the other three used by MCI, Sprint, and AT&T, respectively. In addition, Qwest telecommunication cables run separate from, but almost parallel to the MCI/Sprint/AT&T conduits (Qwest, 2000, MCI, 2000, AT&T, 1990). The Qwest cables consist of four 1¼-inch and two 2-inch diameter lines. The telecommunication cables are about 2 feet bgs to 3 feet bgs.

2.8.1.3 Oil and Gas Pipelines

A 10-inch diameter pipeline owned by Southern Pacific Pipe Lines Inc. runs almost parallel to the railroad alignment (Southern Pacific Pipe Line, 1998). The existing cover is about 50 inches to 55 inches. It connects to tanks located within Taylor Yard. This facility is presently idle and under nitrogen gas pressure. A 20-inch diameter HP crude pipeline owned by Pacific Pipeline System, LLC also runs almost parallel to the railroad alignment (Pacific Pipeline, 2000). The existing cover is about 4 feet at the minimum. An idle 8-inch pipeline owned by Mobil Oil runs along San Fernando Road (Mobil, 2000). It is far enough from the study area that there should be no impact to this facility.

2.8.1.4 Storm Drains

There are several storm drains that cross Taylor Yard at various depths below ground surface. The five major storm drains were identified by RBF (1993) and are described below.

- Project 480, Unit 1, Line A: This drainage facility consists of a 66-inch diameter reinforced concrete pipe (RCP) that conveys flows from the Fletcher Drive railroad crossing and along Casitas Avenue.
- Sycamore Wash: This drainage facility consists of a 10-foot by 10-foot reinforced concrete box culvert (RCB) running under the UPRC tracks transitioning to a 11-foot

by 10-foot concrete open channel for the last 2000 feet before emptying into the Los Angeles River. The storm drain conveys flows from the watershed northeast of Taylor Yard.

- Project 480, Unit 3, Portion of Line B: This drainage facility consists of a 10-foot by 12-foot RCB (Project 479, Unit 1, Line F) that runs along Eagle Rock Boulevard then transitions to an 11.5-foot horseshoe arch tunnel. The arch tunnel begins as the box culvert curves away from Eagle Rock Boulevard, continuing under San Fernando Road and the railroad tracks to the Los Angeles River. The capital discharge for this storm drain is 2,550 cfs (LACDPW, 1991).
- Eagle Rock Drain: This drainage facility consists of a 14-foot by 8-foot RCB that runs along Eagle Rock Boulevard. As it curves towards the Los Angeles River, the culvert transitions to an 8.5-foot by 10.5-foot arch section. It transitions to a 10-foot by 10-foot RCB for approximately 1,000 feet under the UPRC Taylor Yard right-of-way. The capital discharge for this storm drain is 4,550 cfs (LACDPW, 1991).
- City-UPRC Drain: This drainage facility consists of a 48-inch RCP that transitions to a 42-inch RCP as it nears San Fernando Road transitioning again to a 30-inch RCP as it crosses San Fernando Road. The pipe splits into two 48-inch reinforced concrete pipes for the next 1,250 feet and then transitions to an open channel for about 150 feet. The open channel transitions into a single 48-inch pipe for 100 feet before transitioning into a 78-inch corrugated metal pipe (CMP) for the last 100 feet before emptying into the Los Angeles River. The capital discharge for this drainage facility is 130 cfs (LACDPW, 1991).

2.8.1.5 <u>Sewers</u>

The sewer lines that cross the Taylor Yard site include a 24-inch diameter cement pipe that runs southerly along Eagle Rock Boulevard. The pipeline alignment bends at Cypress Avenue and passes across San Fernando Road and Taylor Yard. It then crosses the river in a coupled vitrified clay line (21-inch and 15-inch) and connects to the sewer line underneath Newell Street on the opposite side of the LAR (City, 2000a). Another sewer line is located at the northern end of Taylor Yard along Kerr Street. (City, 2001).

2.8.2 Transportation

UPRC and MTA currently use the main rail line that separates Parcel D and Parcel G for operational and maintenance rail activities. The line is located on an earthen embankment approximately 2 feet to 5 feet above the existing ground surface. In addition, there is a service road that runs from San Fernando Road and passes under the main rail line. The road currently provides access for maintenance operations associated with the MTA facility, LACDPW LAR flood control levee, LADWP electric transmission lines, onsite telecommunication lines, oil lines, gas lines, and City storm drains as well as the UPRC Taylor Yard facility.

Figure 2.7 - Site Infrastructure Components

2.8.3 Flood Protection

The LAR flood control system adjacent to Taylor Yard was completed in 1956. The channel cross-section is trapezoidal in configuration with 3:1 (horizontal to vertical) side slopes and a base width of 220 feet (USACE, 1961). The levee is approximately 23 feet in height from the bottom (invert) of the river channel. The southwestern side slope is protected by grouted riprap and the northeastern slope is protected with concrete. Due to the relatively high groundwater elevation in this reach of the river at the time of construction, the channel bottom is lined with large concrete blocks instead of the concrete that typifies the rest of the LAR flood control system (Evelyn, 2001).

The river channel was originally designed to convey a flow of 83,700 cubic feet per second (cfs) upstream of the confluence with Arroyo Seco (USACE, 1938, Sheet LAR-A-27) and 104,000 cfs downstream from Taylor Yard (USACE, 1938, Sheet LAR-A-26). The recent work of constructing parapet walls along the crest of the flood control levee along the southern reach of the river, carried out by the U.S. Army Corps of Engineers and Los Angeles County Department of Public Works, has increased the capacity of the LAR flood control system south of the City but has no effect on capacity of the channel at Taylor Yard (USACE, 1997).

3. Opportunities and Constraints

3.1 Opportunities

3.1.1 Land Use

Taylor Yard is one of the largest pieces of open land in the downtown Los Angeles area. The site is adjacent to the soft-bottom portion of the LAR, which provides a connection to the existing wildlife in the river and a potential source of water for restoration activities. The current landowner has indicated a willingness to sell the property making this a significant opportunity for implementation of a multiple objective project involving habitat restoration, flood storage improvement, and recreation.

The urban isolation of Taylor Yard, created by the presence of an existing use divorced from urban life (i.e., railroad yard), provides the opportunity to create a distinctive new use celebrating the environment and acting as catalyst to provoke a new urban identity. Based on international standards of open space per inhabitant in urban areas, Los Angeles is deprived of quality open spaces. Los Angeles is one of the world's most prominent urban centers, yet it is dubiously distinguished by a substantial imbalance between built and passive-active open green areas. Therefore, recovery of this area as a permanent open space will create an opportunity for improvement in the quality of urban life.

The Taylor Yard area is well served from a circulation perspective. The immediate adjacency of the site to three freeways (Glendale, Harbor, and Golden State) and to major cross-town arterial streets (San Fernando Road, Figueroa Street, and Broadway) provides a major opportunity for efficient accessibility and exposure as a statement of environmental awareness.

The LAR provides an open space buffer along the southwestern boundary, while the proposed active recreation area in Parcel D and the main rail line embankment provide buffers along the northeastern boundary. This combination of existing and proposed land uses would effectively isolate Parcel G from most human impacts.

3.1.2 Recreation

The location of Taylor Yard within the downtown area of Los Angeles provides an excellent opportunity to create recreational facilities for the urban community. If both Parcels D and G were converted to recreational uses the site would provide 102 acres of open space. This is a large enough area to provide a mixture of recreational uses such sports fields, picnic areas, open space, indoor sports facilities, community center, and fitness trails. In addition, the site would provide sufficient space to restore habitat, thereby increasing local wildlife and providing passive recreational uses such as bird watching and nature trails.

Parcel D could be developed primarily for active recreation, encouraging the surrounding communities to utilize new facilities, such as soccer fields, skate parks, children playgrounds, and other sport fields as well as some passive recreation spaces such as picnic areas. This would fulfill a long-standing need in the area.

During the last year, the local community has been working with local elected officials to develop Parcel D for recreational uses instead of industrial or commercial. The California Department of Parks and Recreation (State Parks) is currently in negotiations with the land developer to purchase between 30 acres and 36 acres leaving the remaining 12 acres to 6 acres for light industrial development. The land purchased by State Parks would be developed primarily for active recreation with some passive recreation uses. Concentrating the active recreation on Parcel D limits the potential negative human impacts to the restored habitat proposed for Parcel G. Parcel G would be used primarily for habitat restoration, flood storage improvement, environmental education, and passive recreation (e.g., walking trails). Therefore, the feasibility study presented in this report is based on the assumption that State Parks will purchase Parcel D and develop the property primarily for active recreation uses with some passive recreation uses.

3.1.3 Biology

The existing habitat conditions on the Taylor Yard site are severely degraded, with little habitat value and no sensitive areas. The site offers the opportunity to restore several habitat types to replace those lost from more than a century of use as a railroad yard or to create regionally scarce habitat types lost throughout the Los Angeles Basin. The site could be used to replace or enhance the lowland riparian habitat along the floodplain of the LAR. The location of Taylor Yard adjacent to the soft-bottom portion of the LAR, combined with the existing riparian habitat in the river channel should yield good recruitment for riparian habitat restoration if appropriate topographic conditions can be provided. Realistically, the site is too small to expect recolonization by taxa that are most sensitive to disturbance by human activity (e.g., nesting Turkey Vulture) or that require an uncontaminated environment (e.g., Arroyo Southwestern Toad [*Bufo Microscaphus Californicus*]).

A regional analysis conducted by Daniel Cooper (Cooper, 2000) indicated that the habitats most endangered in lowland Los Angeles include open habitat scrub plant communities such as riparian thicket, coastal sage scrub, perennial grassland, and alluvial sage scrub. Vehicles, fire, and other human disturbances easily damage these open habitats, therefore these habitats have fared poorly in the development of the Los Angeles basin (Minnich and Denazzi, 1997). Many bird and mammal species are dependent on these open habitats, and these animals are among those in steepest decline, if not entirely extirpated from the Basin (Garrett 1993).

The major plant communities targeted for restoration by Cooper's regional analysis include emergent freshwater marsh, riparian thicket, riparian woodland or sycamore wash, walnut woodland, perennial grassland, coastal sage scrub (Opuntia and sage series), and alluvial fan scrub. The dominant species for each of these communities is shown in Table 3.1 .

Table 3.1 - Dominant Species of Major Plant Communities

Plant Community	Plant species	Common Name
FRESHWATER MARSH	*Typha latifolia*	cattail
	Scirpus americana	bulrushes
	Ludwegia peploides	Water primrose
	Juncus torreyi	Torrey rush
	Juncus patens	Smooth rush
	Cyperus squarrosus	nutsedge
	Carex senta	Sedge
	Carex schottii	Sedge
	Potomogeton natans	Pondweed
RIPARIAN SCRUB	*Sambucus mexicana*	Mexican elderberry
	Salix lasiolepis	Arroyo Willow (shrub)
	Salix laevigata	Red Willow
	Salix exigua	Narrow-Leaf Willow (shrub)
	Rubus ursinus	Calif. Blackberry
	Rosa californica	California rose
	Ribes aureum	Golden current
	Baccharis salicifolia	Mulefat
	Anemopsis californica	yerba mansa or lizardtail
RIPARIAN WOODLAND SYCAMORE WASH	*Symphoricarpos mollis*	Snowberry
	Salix lucida lasiandra	Shining Willow (tree)
	Populus fremontii	Fremont Cottonwood
	Platanus racemosa	California Sycamore
	Lotus scoparius	Deerweed
	Keckiella cordifolia	Heart-leaf penstemon
	Isocoma menziesii	Goldenbush
	Fraxinus velutina	Velvet ash
	Elymus condensatus	Giant ryegrass
	Bromus carinatus	California brome
	Artemisia douglasii	Douglas mugwort
ALLUVIAL FAN SCRUB	*Lepidospartum squamatum*	Scale-broom
	Yucca whipplei	Our Lord's Candle
	Hazardia (Happlopappus) squarrosa	Golden-bush
	Atriplex lentiformis	Big Saltbush

Table 3.1 Cont.

Plant Community	Plant species	Common Name
WALNUT WOODLAND	*Sambucus mexicana*	Mexican elderberry
	Rhus integrifolia	Lemonadeberry
	Rhamnus californica	Coffeeberry
	Phacelia tanacetifolia	Wild heliotrope
	Malosma laurina	Laurel Sumac
	Juglans californica	California Black Walnut
	Hordeum brachyantherum	California Barley
	Heteromeles arbutifolia	Toyon
	Eriophyllum confertiflorum	Golden yarrow
	Baccharis pilularis	Coyote bush
	Aesculus californica	Buckeye
BUNCH GRASSLAND	*Sidalcea malvaeflora*	Checkerbloom
	Nemophila menziesii	Baby blue eyes
	Nassella (Stipa) pulchra	Purple needlegrass
	Nassella (Stipa) cernua	Nodding needlegrass
	Muhlenbergia rigens	Deergrass
	Lupinus bicolor	Two-color lupine
	Gilia capitata	Globe gilia
	Gilia angelensis	Angeles gilia
	Escholtzia californica	Calif. Poppy
COASTAL SAGE SCRUB	*Zauschneria (Epilobium) californica*	California Fuschia
	Yucca whipplei	Our Lord’s Candle
	Trichostema lanata	Wooly blue curls
	Salvia mellifera	Black Sage
	Salvia leucophylla	purple sage
	Salvia apiana	White sage
	Rhus trilobata	Squawbush
	Phacelia distans	Common phacelia
	Malosma laurina	Laurel Sumac
	Malocothamnus fasciculatus	Bush mallow
	Lotus purshianus	Pursh’ lotus
	Eriogonum elongatum	Long-stemmed Buckwheat
	Eriodictyon crassifolia	Thickleaf Yerba Santa
	Encelia californica	Brittlebush
	Elymus condensatus	Giant ryegrass
	Diplacus (Mimulus) longiflorus	Monkeyflower
	Cistus villosa	Rock-rose
	Artemisia californica	California Sagebrush

Table 3.1 Cont.

Plant Community	Plant species	Common Name
CACTUS SAGE SCRUB	*Yucca whipplei*	Our Lord's Candle
	Opuntia littoralis v. Vaseyii	Coastal prickly pear
	O. basilaris	Beavertail cactus
	Mirabilis californica	Wishbone bush
	Lotus purshianus	Pursh's lotus
	Grindelia robusta	Gum plant

Source: Compiled by Cooper, 2000.

Given the proximity of the site to the existing riparian and freshwater marsh vegetation in this stretch of the LAR, the site adjacent to the channel could be rehabilitated to riparian thicket, native perennial grassland, and coastal sage scrub, the habitats most lacking in lowland Los Angeles County. This approach would fill a vital regional need by restoring some of the upland/ riparian fringe open habitat that has been virtually eliminated along the river.

Among riparian plant communities, high canopy cover provided by large trees is not lacking along the LAR in the vicinity of Taylor Yard although these large trees could be removed through future flood control facility maintenance activities. Far less common is the dense willow thicket provided by riparian shrub, a shrub community tolerant of the high shear stresses of frequent flooding. Riparian shrub thickets provide important nesting, feeding, and shelter habitat for a wide range of riparian-dependent songbirds and other species. This plant community is frequently removed for flood control maintenance. This practice has left few areas in the Los Angeles Basin still supporting this important habitat. Therefore, Taylor Yard offers the opportunity to recover this rare plant community.

3.1.4 Hydrology

Taylor Yard's location adjacent to the LAR provides a good opportunity to restore floodplain habitat. Flows could be diverted from the river into a restored habitat area, thereby nourishing the flora and fauna while providing improvements in flood storage. The flows could be diverted through a side weir located on the existing flood control levee or a pumping system could be potentially used to divert low flows from the river channel into the restored habitat area. Local runoff that flows into the site through existing storm drains could be collected and diverted directly to habitat restoration areas if the water quality is suitable. Alternatively, the local runoff could be diverted to a treatment wetlands area for subsequent diversion to habitat restoration areas.

The site could be used to construct treatment wetlands aimed at removing some of the contaminants associated with local urban runoff. While the site would not substantially reduce contamination throughout the Los Angeles basin, it could provide an incremental benefit as part of a large number of treatment wetlands located throughout the basin. This type of 'distributed solution' approach could have substantial positive hydrological and ecological benefits to the river system. However, wetlands constructed for biodiversity would not maximize water quality treatment, as these two wetland types usually require different management strategies.

Taylor Yard provides the following potential sources of water for habitat restoration and/or landscaping for active and passive park recreation areas.

- Direct precipitation across the site
- Local runoff diverted from a storm drain
- Groundwater exposed through excavation
- Groundwater pumped and subsequently treated at the well head
- Treated wastewater delivered by surface pipe from the Glendale STP
- LAR flows delivered by gravity and/or pumping

The habitat restoration objective of Taylor Yard is to develop wildlife habitat alternatives that will thrive on the available water sources so that perpetual irrigation is not needed for plant survival. Supplementary irrigation would be needed initially to establish plant communities for any habitat restoration project. However, the various water sources and potential grading options available at Taylor Yard offer many opportunities to select a native vegetation plant palette for a given combination of water sources and ground elevations.

3.1.5 Flood Storage

The proximity of Taylor Yard to the LAR offers the potential to improve flood storage and reduce downstream flood hazards. The site could be excavated and connected to the river channel via a side weir structure on the upstream end to divert peak flood flows into the site for storage and subsequent release after the storm flows have subsided. This concept was previously analyzed in the Multi-Use Study (RBF, 1993). That study concluded that the site was too small to provide meaningful flood storage improvement to the downstream portion of the LAR where it is most needed (Compton to Long Beach). Based on that finding, the project site is not likely to have a significant beneficial impact on flood storage, since it is smaller then the site analyzed in the Multi-Use Study. However, if restoration of Taylor Yard is viewed in the context of a regional floodplain restoration program then the site offers the potential to improve flood storage on an incremental basis. In this sense, restoration of Taylor Yard would be the first phase of a larger project consisting of numerous similar phases located along the floodplain of the LAR. Evaluation of the number of similar type projects needed to have a significant impact on flood storage within the Basin was conducted by PWA and summarized in Chapter 5.0. A copy of the complete PWA report is also available in Appendix B.

3.1.6 Water Quality Improvement

3.1.6.1 <u>Surface Water</u>

The Taylor Yard site provides many opportunities for improving surface water quality through Best Management Practices (BMPs). The BMPs that potentially could be implemented at Taylor Yard include treatment wetlands and downstream treatment facilities.

Treatment Wetlands

A treatment wetland is a constructed wetland designed to treat water sources using natural processes involving vegetation, soils, and microbial assemblages. In addition to water quality improvement, treatment wetlands provide beneficial uses associated with a natural wetland such as wildlife habitat and passive recreation. A treatment wetland is typically constructed off stream to avoid potential impacts to other waters.

A treatment wetland improves the quality of water by removing contaminants via a combination of physical, chemical, and biological mechanisms. Table 3.2 shows the primary mechanisms that effect contaminant removal.

Table 3.2 - Contaminant Removal Mechanisms for Treatment Wetlands

Mechanism	Process
Physical	Sedimentation, filtration, and volatilization
Chemical	Precipitation, adsorption to sediments, flocculation, and transformation
Biological	Plant and microbial uptake

Source: USEPA, 1999

A treatment wetland needs to be designed carefully to ensure that it functions as intended. Table 3.3 lists some of the major design considerations for a treatment wetland (USEPA, 1996; USEPA et al., 1999).

Table 3.3 - Major Design Considerations for Treatment Wetlands

Consideration	Description
Minimal Impacts	Minimize potential for: • altering hydrologic regimes of adjacent or downstream water bodies • degrading downstream water/groundwater quality • disrupting local biological diversity
Natural Configuration	Use geomorphically appropriate structures, natural design configurations, and native plant species
Buffer Zones	Set up vegetated filter strips around the wetland margin as buffer zones
Dry-Season	Ensure adequate dry-season base flow for vegetation

Table 3.3 Cont.

Consideration	Description
Hydrology	maintenance
Flow Residence	Use baffles, islands, peninsulas to prevent flow short-circuiting and increase water/ wetland residence times.
Biological Diversity	• Provide habitat with a broad range of native species • Provide diverse physical features (islands, peninsulas, buffers, open water) • Provide adequate control of invasive exotic species
Storm Conditions	• Include considerations for flow storage and treatment capacity under high flow conditions • Adequately size the wetland according to drainage area served and design inflow
Forebay	Use forebay to pre-treat inflows through sedimentation to: • Reduce treatment loads of the wetland • Reduce wetland maintenance needs

Source: USEPA, 1996; USEPA et al., 1999

Other considerations include facilitating maintenance and public use of the wetland. These design considerations provide a basis for establishing design criteria for a properly functioning treatment wetland.

Water Quality Facilities

Water quality facilities are generally BMPs used to treat water sources including storm water runoff and effluent through physical and chemical mechanisms. These facilities are either constructed or landscaped. The specific pollutant removal mechanisms vary with the types of the facilities. Table 3.4 shows some of the more common water quality facilities that could be considered for the Taylor Yard project as a downstream treatment facility.

Table 3.4 - Water Quality Treatment Facilities

Facility	Description	Function	Reuse Receiving Water
Infiltration Basin	Constructed pond with grassed, sandy bottom for infiltration to groundwater.	Dissolved and particulate pollutant removal through sedimentation, filtration, adsorption and microbial activities in soil.	Groundwater
Infiltration Trench	Constructed trench with gravel backfill and sand filter layer for infiltration to groundwater.	Same as above.	Groundwater
Sand Filter	Constructed sand bed (filter) with underdrain pipes. Inflow filters through sand bed and discharges to receiving water.	Significant removal of sediments, metals, nutrients, BOD and coliforms through filtration.	Streams. Water supply reservoirs
Wet Pond	Constructed basin with permanent ponding and sized to store runoff for extended detention and controlled release.	Cost-effective removal of pollutants through settling, chemical transformation, biological nutrient uptake and soluble nutrient infiltration through soil.	Groundwater. Streams. Water supply reservoirs.

Source: USEPA, 1996.

Designs for these facilities are relatively well established and can be readily considered to treat or polish the outflow from any proposed wetland restoration at Taylor Yard to meet the water quality objectives.

3.1.6.2 Groundwater

The contaminated groundwater underlying the site provides an opportunity to use a portion of the site for groundwater remediation. Groundwater could be pumped to the surface and treated at the wellhead using conventional remediation technologies to remove the bulk of contaminants. The treated groundwater could then be discharged into restored riparian wetlands (e.g., emergent marsh with extensive reeds) for final polishing prior to discharge into the LAR, return to the municipal water supply, or injection back into the groundwater aquifer. There are many regulatory issues that would have to be addressed to implement this option; however, it might prove beneficial even if it is only pursued as a demonstration project.

3.1.7 Soil Quality

The contaminated soil underlying Taylor Yard provides an opportunity to implement unique contaminated soil removal or stabilization techniques in an urban environment. Some of these technologies could be implemented onsite, thereby rendering the soil suitable for reuse or placement at an offsite disposal facility such as a landfill. Some of these methodologies would require excavation and hauling of the contaminated soil to a hazardous material remediation facility. A combination of onsite and offsite remediation would most likely provide the optimal treatment program; however, the clean up levels required for the ultimate land use (e.g., habitat restoration) must be established to develop the site-specific treatment program. The most promising soil remediation technologies that could be used at Taylor Yard based on human health risk remediation requirements are described in Chapter 3.2.7.

3.1.8 Soil Disposal

The location of Taylor Yard at the confluence of three major freeways (Glendale, Harbor, and Golden State) and two rail lines (UPRC and MTA) provides opportunities for transportation and subsequent disposal of excavated soil. Construction equipment could gain access to the site via San Fernando Road and there is adequate space for construction equipment storage and parking. An existing spur railroad line could be left in place during construction for loading of excavated, contaminated soil onto rail cars for transportation to offsite remediation and disposal facilities. Soil that is remediated onsite could be loaded onto rail cars for transportation to potential disposal sites such as the ports (fill) or cover material at sanitary landfills. Rail transportation could reduce transportation costs and potential concerns regarding environmental impacts associated with transportation via roads and highways.

3.1.9 Infrastructure

The availability of such a large piece of land adjacent to the LAR could provide an opportunity to create a more natural river edge. The flood control levee could be relocated away from the river to a location adjacent to the main rail line embankment. This would expand the floodway and restore a portion of the natural floodplain. Flood flow velocities could be lowered and more riparian habitat could be established in the expanded river channel. Of course, the existing level of flood control protection would have to be maintained under any project alternative involving flood control system modification.

3.2 CONSTRAINTS

3.2.1 Land Use

Although Taylor Yard Parcel G represents one of the largest pieces of open space adjacent to the LAR, at just over 61 acres it is still relatively small from the standpoint of habitat area and flood storage. Even the presence of limited passive recreation spaces, such as paths and trails, could have a negative impact on the area available for habitat and flood storage. This condition necessitates the incorporation of creative design solutions to accommodate all the potential site components. For example, nature trails could be elevated on catwalks to allow unobstructed views of the habitat below while minimizing human contact.

The current zoning of Taylor Yard and its immediate surroundings is industrial. City zoning allows for related land uses of lesser intensities to be built within a particular zoning category; however, significant deviations would require a zoning change or waiver. An alternative to obtaining a zoning change would be to develop a specific plan for the area providing a bridge between the existing General Plan and individual project submittals. A specific plan can be developed to amend the zoning ordinance to create a more appropriate land use or density designation.

3.2.2 Recreation

The major constraints concerning recreational activities are related to the selection of the dominant use for Parcel G. The intent of the current study is to develop alternatives that provide habitat restoration, flood storage improvement, and recreational facilities on Parcel G. However, the available space limits the development of all three components within this parcel. Incorporation of active recreation areas within Parcel G would constitute a major constraint in the development of the area to meet the desired multiple objectives. Development of Parcel D for active recreation uses would reduce this constraint by reducing the uses for Parcel G to habitat restoration and flood storage improvement.

3.2.3 Biology

A major constraint to wildlife habitat enhancement at Taylor Yard is the requirement to recover floodplain topography on the site. Recovery of sustainable populations of native plants and animals could perhaps be accomplished best by removal of the fill over the original geomorphic floodplain surface. The extent of excavation required to achieve the low elevation land which could support riparian thicket, emergent marsh, or constructed wetland for water quality improvement is a significant constraint to recovering these habitat types.

After excavation and removal of the onsite contaminated soil, the remaining soil may not be suitable for successful revegetation of the desired plant communities and this would pose a potential constraint to habitat restoration. Physical (e.g., sand), chemical (e.g., nitrogen), and biological (e.g., bacteria) amendments might be needed to enhance the soil properties. Although the need for reintroduction of soil micro-organisms such as beneficial soil bacteria, mycorrhizal fungi, and other organisms normally found in living soil is recognized it is difficult to quantify. Numerous experimental techniques have been developed to enhance the recovery of soils and these techniques could be applied at Taylor Yard. However, some additional research may be needed to identify the thresholds of tolerance which native plants can endure in soils contaminated with heavy metals, petroleum hydrocarbons, and other known site contaminants.

3.2.4 Hydrology and Hydraulics

There are many constraints related to the hydrology and hydraulics of Taylor Yard and the surrounding area. Some of the constraints are intertwined with constraints related to water quality such as the diversion of local runoff from storm drains that might be feasible from a hydraulic standpoint but constrained by water quality issues. The most significant hydrologic and hydraulic constraints are discussed below and constraints related to water quality are presented in Chapter 3.2.6.

3.2.4.1 Water Rights

Issues related to water rights could pose a significant constraint to project development by limiting water sources and/or increasing costs associated with water use. The City of Los Angeles has exclusive rights to the waters of the ULARA by the "pueblo right" an authority believed to have first been granted when Los Angeles was founded in 1781. The Pueblo right was first upheld by the court in 1895 (Vernon Irrigation Co. v. Los Angeles, 1895). The 1979 San Fernando Judgment (Superior Court Case No. 650079) granted the City of Los Angeles the Pueblo rights to all waters within the San Fernando Basin (Blevins, 2001). Section 5.1.1.1. of the judgment states:

> *Los Angeles, as the successor to all rights, claims, and powers of the Spanish de Los Angeles in regard to water rights, is the owner of a prior and paramount pueblo right to the surface waters of the Los Angeles River and the above ground waters of the San Fernando Basin to meet its reasonable beneficial needs and for its inhabitants.*

Section 5.1.1.4 states:

> *No other party to this action has any right in or to the surface waters of the Los Angeles River or to the native safe yield of the San Fernando Basin.*

The Watermaster was contacted in December 2000 to determine potential water rights concerns related to project development and the following were identified (Blevins, 2001).

- Any diversion of flows from the LAR, local runoff, or groundwater would have to be approved by the Watermaster.
- Any consumptive use (net loss) of water from the ULARA would require payment to the City of Los Angeles because the losses would be deducted from the City's Stored Water Credits.
- Any water diverted from the LAR, local runoff, or groundwater could be returned to the municipal water supply to reduce consumptive use payments; however, due to potential water quality issues it is highly unlikely that water used to restore habitat at Taylor Yard could be returned directly (i.e., without prior treatment) to the municipal

drinking water supply system. Reuse of the water for irrigation purposes might be possible, however, all such uses would have to address water quality concerns and be consistent with pueblo rights.

- A portion of the upstream treated wastewater effluent is not included under the pueblo rights, however, the City is planning to divert a large portion of the effluent currently discharged to the LAR to spreading grounds located upstream (e.g., Hansen Spreading Grounds) and/or into the reclaimed water supply system for irrigation use.
- Due to the existing levels of soil and groundwater contamination at Taylor Yard, the site would most likely not be a suitable location for a spreading ground. In addition, there are no groundwater production wells located down gradient from the site that could extract groundwater for the benefit of the City.

The Watermaster indicated that the concerns identified above were based on general questions and information regarding project development at Taylor Yard. He also said that specific comments and concerns would require a detailed review of project alternatives once available.

3.2.4.2 Groundwater Flow

The relatively high elevation of the groundwater underlying the project site might pose a constraint to project development due to the relatively high hydrostatic pressures generated by groundwater. The relatively high groundwater elevation and associated hydrostatic pressures are the reasons the LAR channel bottom was not encased in concrete through this reach of the river. Project components (e.g., contaminant liner) that would significantly block vertical groundwater flow would have to be designed to withstand these pressures. This could possibly be accomplished through the use of pumping systems to lower groundwater levels and/or divert groundwater flows.

Due to the fact that the groundwater underlying Taylor Yard is contaminated, components that would significantly affect vertical or horizontal groundwater flow might be precluded for legal reasons. For example, a liner designed to isolate the restored habitat and withstand the hydrostatic pressures would probably alter the vertical and lateral flow of groundwater under the site. This could redirect contaminated groundwater towards areas that are currently clean, thereby posing a liability through indirect contamination of a previously clean site. Detailed groundwater modeling would be required to develop project alternatives that do not adversely affect groundwater flow and associated contaminant plume migration.

3.2.5 Flood Storage

While the proximity of Taylor Yard to the LAR offers the potential to improve flood storage, Parcel G covers an area of just over 61 acres, thus limiting its usefulness. Even if the entire site were excavated to the same elevation as the adjacent river channel by cutting about 25 feet in depth it would yield a maximum flood storage capacity of about 1,500 acre-feet. This is similar to some of the alternatives previously analyzed by the USACE, LACDPW, and RBF and determined to be ineffective at improving flood storage where it is most needed throughout the LAR flood control system.

The upstream portion of the site is located on the outside of a channel bend, which is subject to high channel velocities and hydrodynamic forces. In addition, this might be an area characterized by a mixed flow regime subject to both subcritical and supercritical flows. These conditions would make it difficult to design a side weir structure capable of diverting flood flows during peak flow conditions.

3.2.6 Water Quality

There are many constraints associated with the quality of the surface water in the vicinity of Taylor Yard as well as the groundwater underlying the site. Due to the City's exclusive rights to water, project development will be constrained by the water quality limitations of the San Fernando judgment (Blevins, 2001). In addition, there are constraints imposed by the California Department of Health Services (DHS), State Water Resources Control Board (SWRCB), DTSC, LARWQCB and USEPA. Any water returned to the municipal drinking water supply system or the City's reclaimed water supply system would have to meet criteria, standards, and objectives set by the DHS. Water returned to the LAR would probably require a NPDES discharge permit; therefore, the water quality would have to meet applicable criteria, standards, and objectives set by the USEPA and SWRCB (through the LARWQCB). In addition, water used for habitat restoration would have to meet various constraints related to plant establishment (e.g., salinity and pH) to improve the chances for restoration success. A screening level ecological risk assessment was performed to determine contaminants of potential concern. A detailed discussion of the findings related to groundwater is given in Chapter 3.2.7.1.

3.2.7 Soil Quality

The contaminated soil underlying Taylor Yard poses a significant constraint to project development due to potential human and ecological health risk increases as well as increased soil excavation and disposal costs. The project could pose an increase to human health risk through potential exposure to contaminants deemed toxic to humans. Toxic substance exposure could occur during construction through direct contact of contaminated soils or breathing of particulate matter released by construction activities. Any soil remaining after construction that offers the potential for human contact (e.g., topsoil underlying park areas) would have to be remediated such that contaminant levels are suitable for human contact. Remediation of contaminated soil to levels appropriate for proposed human end uses (e.g., park use, industrial fill, landfill cover) at Taylor Yard and disposal sites is a significant constraint for project development.

Wildlife could be exposed to contaminants via pathways similar to humans; however, the effects on wildlife could be different. The same type of contaminant at identical concentrations could have different effects on the wildlife that would use Taylor Yard compared to humans. For example, aquatic invertebrates that live in soil would be more likely to be adversely affected due to the increased duration of exposure. Remediation of contaminated soil to levels appropriate for the proposed habitat (e.g., wetlands and uplands) at Taylor Yard and the associated disposal sites (e.g., landfills) is a significant constraint for project development. Investigations known as ecological risk assessments and human health risk assessments would be required to determine contaminants of potential concern, exposure pathways, toxicity effects, and remediation levels for the proposed flora, fauna, and human health associated with various habitat restoration alternatives.

3.2.7.1 Screening Level Ecological Risk Assessment

A screening level ecological risk assessment (SLERA) of potential contamination of soil and groundwater at Taylor Yard was conducted by EVS Environment Consultants, Inc. (EVS). EVS utilized available contaminant data to determine if additional analyses would be required to assess ecological health risk. The primary objective of the SLERA was to eliminate contaminants that do not pose a risk and to identify those contaminants that may pose a risk to organisms, but need further evaluation. Maximum concentrations of contaminants measured on the site were compared to protective benchmarks to establish possible risks to aquatic and terrestrial wildlife that might use the habitat under current and future conditions. The SLERA is summarized in this Chapter and the full report is presented in Appendix B.

The screening level evaluation was conducted using the existing information contained in the following sources.

- Summary soil data table provided by Elizabeth Robbins, Miller Brooks Environmental, Inc. (data document, 2001, based on ERM 2000a); and
- Semi-Annual Groundwater Monitoring Report, No. 16. August 1999 – January 2000, Taylor Yard, Los Angeles, California (ERM 2000b).

The soil data used for this assessment were collected between June 1998 and February 1999 and groundwater data were collected between August 1999 and January 2000 (ERM 2000a,b). These data were used to evaluate the risk posed by contaminants for the various types of restoration at Taylor Yard. Based on the potential range of restoration alternatives, the SLERA used both soil and sediment benchmarks for assessing soil contaminants and surface water benchmarks for assessing groundwater contaminants.

Parcel G supports few biological communities at this time, while surrounding areas support a variety of birds, small mammals, reptiles, amphibians, and terrestrial insects. Aquatic communities of the LAR adjacent to Taylor Yard include benthic invertebrates, crayfish, fish, water birds, and small mammals. The proposed alternatives focus primarily on providing habitat for birds; however, benthic invertebrates, fish, mammals, reptiles, and amphibians would also be found on the restored site. Restoration activities could provide a mixture of open water, emergent marsh, riverbank, and upland fringe habitat.

Contaminants of potential concern (COPCs) were identified by comparing the maximum concentration measured in soil and groundwater at the site to available screening benchmarks, criteria, or guidelines. The classes of compounds that were considered as COPCs were volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) including polycyclic aromatic hydrocarbons (PAHs), and trace elements.

The concentrations of COPCs measured at the site during 1998 to 2000 were compared to the screening benchmarks for soil, sediment, and water. The compounds that exceeded published criteria or benchmarks were considered COPCs for the media where exceedences occurred. The results are summarized below in Table 3.5.

The fate and transport of the COPCs was analyzed to assess the potential exposure of various COPC to the targeted receptors. In general, the major exposure pathway for VOCs in terrestrial organisms, including invertebrates, birds, and mammals, is through direct contact with and ingestion of contaminated soils and inhalation of volatile compounds. VOCs are not known to biomagnify through the food web.

The major exposure pathway for SVOCs (e.g., PAHs) in terrestrial organisms, including invertebrates, birds, and mammals, was found to be direct contact with and ingestion of contaminated soils. Benthic invertebrates, fish, amphibians, and aquatic birds may be exposed to SVOCs via direct contact with or ingestion of contaminated sediments. Food-chain exposure is not expected to be a major exposure route for SVOCs, although insectivorous birds may ingest invertebrates contaminated with SVOCs. SVOCs do not tend to biomagnify; therefore, predatory birds and mammals would be at a low risk of exposure to SVOCs.

The major exposure pathway for trace elements to terrestrial invertebrates was found to be through direct contact with and ingestion of soil. Mammals and birds at the site may also be exposed to trace elements through direct contact with and ingestion of soil and surface water at the site and through ingestion of invertebrates coming in contact with contaminated soil. None of the trace elements detected in soil tend to biomagnify through the food web. Benthic invertebrates, fish, amphibians, and aquatic birds may be exposed to trace elements via direct contact with and ingestion of contaminated food, sediment, and surface water.

Hazard quotient calculations were used to screen for risks posed to terrestrial, benthic, and aquatic organisms from contaminants in the soil and groundwater. Hazard quotients were calculated as the ratio of the maximum concentration measured at the site divided by the corresponding benchmark so a value greater than 1.0 implies potential risk. VOCs exhibited hazard quotients ranging from 6 to 420 and quotients for SVOCs ranged from 1.2 to 38. The hazard quotients for trace elements ranged from 3.7 to 1,150. Similar analyses were conducted to assess the risk to benthic organisms for soil that becomes sediment (i.e., soil in transport) as well as the risk to aquatic organisms exposed to groundwater that becomes surface water.

Based on the results of the SLERA, exposure to the existing soil on Taylor Yard may pose a risk to terrestrial organisms. However, the screening results are likely to overestimate the risk to birds, the primary species of concern, because the benchmarks are based on toxicity to soil invertebrates or microorganisms that are in direct contact with the soil. In addition, because these benchmarks were developed for screening purposes, the levels are very protective. The results also indicate a probable risk to benthic organisms for existing soil that becomes sediment. In addition, aquatic organisms may be at risk if groundwater is not diluted by any other water source when it becomes surface water.

Table 3.5 - Contaminants of Potential Concern (COPCs) at Taylor Yard

Chemical (mg/kg)	Soil	Soil as Sediment	Groundwater as Surface Water
Volatile Organic Compounds (VOCs)			
1,1-Dichloroethane	X		X
1,2-Dichloroethene			X
Tetrachloroethene	X		X
1,1,1-Trichloroethane	X		
Trichloroethene	X		
Semi-Volatile Organic Compounds/PAHs			
Benzo(a)pyrene		X	
Benzo(b)fluoranthene	X		
Benzo(a)anthracene	X	X	
Naphthalene	X		
Benzyl alcohol			X
Benzoic acid			X
Bis (2 ethylhexyl) phthalate			X
Trace Elements			
Antimony	X		
Arsenic	X	X	
Barium			X
Cadmium			X
Chromium	X	X	
Cobalt			X
Copper			X
Lead	X	X	X
Nickel	X	X	
Selenium			X

Source: ERM, 2000a

3.2.7.2 Soil Remediation

There are many soil remediation methods that could be employed to clean up the contaminated soil at Taylor Yard. Some of these technologies could be implemented onsite, thereby rendering the soil suitable for reuse or placement at an offsite disposal facility such as a landfill. Some of these methodologies would require excavation and hauling of the contaminated soil to a hazardous material remediation facility. A combination of onsite and offsite remediation would most likely provide the optimal treatment program; however, the clean up levels required for the ultimate land use (e.g., habitat restoration) must be established to develop the site-specific treatment program. The most promising soil remediation technologies that could be used at Taylor Yard are described below.

Onsite Fixation and/or Stabilization

Onsite fixation, stabilization, or encapsulation can be performed on materials to reduce the mobility or solubility of the contaminants. Mobile or soluble chemicals can be fixated to limit migration potential. The physical nature and handling characteristics of the waste are not necessarily changed by stabilization, but reagents can be designed to modify the geotechnical properties of the waste. Solidification or encapsulation reagents are used to mechanically bind the waste to restrict chemical migration by decreasing the surface area exposed to leaching and/or isolating the wastes. This process would allow for the potential reuse of the treated material onsite. Onsite stabilization is required for RCRA hazardous waste and requires an onsite permit to construct a treatment facility.

Onsite Bioremediation and Onsite Reuse

Excavated soil is screened as necessary and then it is placed in a treatment area where the treatment base is compacted and surrounded by berms constructed of clean soil. The impacted material is placed in the treatment area in approximate 18-inch lifts. The material is then watered and aerated. The amount of time required to treat each lift is dependent upon the type of contaminant, amount of handling, watering, and cleanup levels. The application of this technology may be limited by the amount of space available for long-term treatment areas. Permitting requirements do not allow for the treatment of RCRA hazardous waste and volatile emissions must be monitored and controlled.

Offsite/Onsite Thermal Desorption

Thermal desorption involves the heating of soil to a temperature necessary to volatilize contaminants in the soil. The volatilized contaminants are captured or destroyed in an air pollution control system. Thermal desorption can be conducted onsite or offsite. Mobile or onsite treatment units can process 30 to 50 tons of material per hour. Fixed or offsite units can process 50 to 150 tons per hour. The material must be screened to remove debris and over-sized material. The material is heated to predetermined temperatures based on the contaminant in the soil. The contaminant is removed by phase transfer and processed at an increased temperature by a thermal oxidizer. The material is then cooled, stockpiled, and profiled for onsite reuse or offsite disposal.

Excavation and Offsite Recycling

The soil could be excavated and hauled to an asphalt paving recycling facility located offsite. The material would be transported from the site and screened at the facility. Depending on the alternative, a portion of the material will need to be replaced by clean imported soil. The recycling facility will issue a certificate of recycle to the generator.

Excavation and Offsite Disposal

The soil could be transported from the site for disposal in a Class I, II, or III landfill facility as appropriate for the type of contaminant present. The material would be transported from the site and disposed of as nonhazardous, non-RCRA hazardous, or RCRA hazardous material based on the chemical composition. Disposal would include excavation, transportation, disposal fees, and classification of the developer as a generator.

In Situ Vapor Methods

The soil can be treated in place using in situ vapor extraction. VOCs are extracted from the soil in vapor form and treated using granular-activated carbon or other methods. The biodegradation of VOCs can be enhanced by the injection of nutrients into the substrate. Soils can be flushed by injection of suitable solutions by first injecting the material and then recovering the fluids and treatment at an offsite facility. The most effective onsite treatment technique for this site is vapor extraction, which was determined by the CDTS.

3.2.8 Soil Disposal

Constraints, related to soil disposal, center primarily on three issues: (i) soil contamination, (ii) disposal site capacity, and (iii) traffic impacts. These issues are discussed in more detail below.

The level of soil contamination will dictate which disposal options are appropriate for soil excavated from the project site. Disposal site suitability will depend on the contamination type, contaminant concentrations, and volume of contaminated soil. As mentioned previously, it might be possible to remediate some of the contaminants onsite to levels suitable for disposal at a wider range of locations. For example, it might be possible to remediate some of the contaminated soil to levels suitable for industrial use, so that the soil could be hauled to the ports (e.g., Port of Los Angeles or Port of Long Beach) and used for fill.

The capacity of available disposal sites might pose a constraint depending on the volume of excavated soil associated with various restoration alternatives. Disposal site capacity could be a problem even if the soil is clean because implementation of an alternative that involves excavation to elevations similar to the LAR would require cutting an average of approximately 25 feet of soil. Finding a disposal site capable of handling this volume of soil (approximately 1 to 2 million cubic yards), especially contaminated soil, represents a significant constraint to project development. It is likely that an array of sites would be needed for disposal of excavated soil.

Construction-related traffic impacts could pose a significant constraint to project development. Given that the capacity of a double-loaded dump truck is about 20 cubic yards, approximately 50 roundtrips would be needed for every 1,000 cubic yards of excavated soil that must be hauled offsite. Therefore, approximately 50,000 to 100,000 roundtrips would be needed to haul the 1 million to 2 million cubic yards of soil associated with the scenario presented above. Based on construction five days a week for 50 weeks per year, this would result in approximately 100 to 200 roundtrips per day for a one-year construction timeframe. Using rail to move a portion of the contaminated soil would decrease impacts to car traffic, however it might have a significant adverse impact on rail transportation that would pose a potential constraint.

Since it might not be possible to remediate some or all of the soil to levels suitable for plants or organisms, clean fill also would be needed as backfill to minimize the risk of contaminant exposure. Identifying a source of clean soil suitable for backfill in restored habitat areas could pose a constraint to project development. While it might be possible to locate clean topsoil in sufficient quantities, it is more likely that clean import would be hauled to the site where it would be mixed with various soil amendments to improve the plantability of the soil, especially for native plants.

3.2.9 Infrastructure

The existing infrastructure facilities located on or near the project site pose potential constraints to project development. While there are some constraints related to environmental impacts and engineering feasibility, most of these constraints relate directly to increased construction and maintenance costs. The potential constraints associated with the various infrastructure facilities are summarized below.

3.2.9.1 Transportation Elements

The main rail line running along the embankment that bisects the site must be maintained for rail service use by the MTA. In addition, the track must provide continual rail service throughout project construction so any modifications to the rail line must be done in a phased approach utilizing detours to provide uninterrupted service.

The functionality of the service road that extends from San Fernando Road to the MTA maintenance facility cannot be adversely impacted by project development. The road would still be needed in the future after project development for maintenance of the rail line, flood control levee, LAR channel bed, storm drains, and electric transmission lines as well as cable, oil, and gas lines.

3.2.9.2 Flood Control Levee

The functional performance of the flood control levee must be maintained so that the existing level of flood protection is not reduced. This means that proposed project development options cannot allow increased water levels at the project site or in the river channel upstream and downstream from Taylor Yard. This might mean that ground elevations around the perimeter of the proposed project have to be raised to limit areas of flood inundation.

3.2.9.3 Electric Transmission Lines

Overhead electric transmission lines and their supporting towers are found along the flood control levee bordering Taylor Yard. The areas served by these electric transmission lines must continue to be served at the same level during project construction and after project implementation. The electric transmission lines would either have to be protected in place or relocated farther from the riverbank. In addition, vehicle access to all transmission towers must be maintained to allow continued servicing of this important infrastructure facility.

3.2.9.4 Cables and Pipelines

The customers served by the existing utility lines that provide cable, telephone, oil, and gas must receive continuous service during and after project construction. This could be done by protecting the existing facilities in place or by realigning the utility infrastructure (e.g., along the existing main rail line).

3.2.9.5 Storm Drains

The storm flow capacity of the existing storm drains that cross the site must be maintained during and after project construction. Conflicts between all storm drains and the various alternatives have been avoided with the exception of the City's two 48-inch storm drains (that connect to one 78-inch storm drain). One solution to the conflict, might be to divert this storm water, in some alternatives, into the restoration area for subsequent delivery to either the groundwater basin or LAR.

3.2.9.6 Sewer Lines

Sewer lines that run across the site would likely not be affected by any of the alternatives developed. They will remain and should be protected in place during construction.

4. ALTERNATIVE DEVELOPMENT

4.1 APPROACH

The first step in alternative development was to use the opportunities described in Chapter 3.0 to prepare a list of project objectives. Several potential methods were then identified that could be implemented to achieve each objective. There are many other combinations of objectives that could be achieved with each alternative and some of the components could be interchanged from one alternative to another. For example, the various Parcel D recreational facility configurations could be interchanged between alternatives. The project objectives and potential methods for achieving the objectives are presented in Table 4.1.

The next step in alternative development was to use the constraints to reduce and group the objectives into a reasonable number for development of a single project alternative. Some of the project objectives are mutually exclusive making it difficult to select one "optimal or balanced" alternative. For example, maximizing the opportunity to improve flood storage would require a large volume of excavation while maximizing the area of upland riparian fringe habitat would require a small volume of excavation. For this reason, the following subset of major objectives was used to develop four alternatives that frame a range of possibilities for project implementation at Taylor Yard.

1. Optimize flood storage
2. Optimize habitat diversity
3. Optimize upland habitat
4. Minimize soil excavation
5. Restore natural floodplain
6. Provide active and passive recreation areas

The following four alternatives were developed for implementation on Parcel G of Taylor Yard.

- Alternative 1: Optimize Flood Storage – provide significant flood storage and riparian habitat (i.e., not a barren detention basin). (Figure 4.1 and Figure 4.2)
- Alternative 2: Optimize Habitat Diversity – provide biologically diverse floodplain, riparian and upland habitat with some flood storage. (Figure 4.3 and Figure 4.4)
- Alternative 3: Optimize Upland Habitat – provide significant upland riparian fringe habitat with minimal soil excavation. (Figure 4.5 and Figure 4.6)
- Alternative 4: Naturalize River Edge (Remove River Levee) – restore portion of historical floodplain thereby naturalizing the river's edge, providing riparian habitat, and increasing the floodway width. (Figure 4.7 and Figure 4.8).

Table 4.1 - Project Objectives and Potential Methods for Achieving the Objectives

Objective	Method	Alt.1: Optimize Flood Storage	Alt. 2: Optimize Habitat Diversity	Alt. 3: Optimize Upland Habitat	Alt. 4: Remove River Levee
Flood Storage Improvement					
Increase Channel Flow Capacity	Expand Channel Cross-Section				✓
Lower Peak Flow Through Channel	Increase Flood Detention Of Channel	✓			
Stabilize Banks With Vegetation	Use Biostabilization Bank Protection	✓			✓
Restore Floodplain	Remove Channel Levee	✓			
Lower Peak Flow From Local Runoff	Divert Local Runoff Into Wetlands	✓	✓		
Hydrology					
Use River Flows	Divert LAR Flows Via Open Channels	✓			✓
Use River Flows	Divert LAR Flows Via Pumping And Pipes	✓	✓		
Use Groundwater	Pump, Treat, And Return To Groundwater		✓	✓	
Use Groundwater	Pump, Treat, And Discharge To LAR		✓		
Use Groundwater	Pump And Return To Groundwater (clean)		✓	✓	
Use Local Runoff	Treat, Use, And Recharge	✓	✓	✓	
Use Local Runoff	Use/Treat And Discharge To LAR		✓		
Use Direct Precipitation Only	Allow Direct Percolation			✓	
Groundwater Contamination					
Remove Contamination Prior To Restoration	Local And Regional Cleanup Program	✓	✓	✓	✓
Treat Contamination Through Restoration	Pump, Treat, And Recharge		✓	✓	

Objective	Method	Alt.1: Optimize Flood Storage	Alt. 2: Optimize Habitat Diversity	Alt. 3: Optimize Upland Habitat	Alt. 4: Remove River Levee
Remove Contamination Over Time	Pump And Treat In Phases			✓	
Isolate Restoration From Contamination	Install Groundwater Barrier (liner)	✓	✓	✓	
Soil Contamination					
Fix Contaminants In-Place	Soil Stabilization And Soil Capping			✓	
Isolate Restoration From Contamination	Soil Capping And Lining	✓	✓	✓	
Remove All Contaminants	Excavate, Haul, And Remediate	✓	✓		✓
Remove All Contaminants	Remediate, Excavate, And Haul	✓	✓		✓
Biology					
Increase Bird Loafing And Migration	Open Water Habitat	✓			
Provide Habitat Diversity And Improve Water	Emergent Wetlands Habitat	✓	✓		
Replace Rare Habitats	Riparian Thicket Habitat	✓	✓		✓
Replace Rare Habitats	Alluvial Fan Habitat	✓	✓		✓
Replace Rare Habitats	Upland Coast Sage Scrub Habitat	✓	✓	✓	✓
Replace Rare Habitats	Bunchgrass Habitat	✓	✓	✓	✓
Provide Raptor Perches And Habitat Diversity	Upland Woodlands	✓	✓	✓	✓
Community Connection					
Educate Public On LAR Resources	Nature Center And Nature Trails	✓	✓	✓	✓
Provide Physical Link LAR	River Edge Park Theme	✓	✓	✓	✓
Extend Regional Connection Links	Regional Trail Links (walking and cycling)	✓	✓	✓	✓
Provide Active Sports Fields	Active Open Fields On Parcel D	✓	✓	✓	✓

The proposed conversion of Parcel D to active and passive recreation areas by the California Department of Parks and Recreation would achieve Objective 6 above. Parcel D is needed to provide the critical functions of public access to open space and recreation lands. Creation of active recreation areas on Parcel D is critical to relieve the pressure for such recreation areas that would otherwise be directed onto Parcel G. If this public pressure is directed at Parcel G, little opportunity exists to conduct authentic habitat recovery for vulnerable native plant communities. Therefore, the four alternatives are based on the assumption that Parcel D be developed for active and passive recreation. Several different configurations for recreational facilities were developed for Parcel D for illustrative purposes only. A detailed assessment of recreation needs should be conducted to develop the best mixture of active and passive recreation facilities for Parcel D.

Certain features are relevant to all the alternatives. For example, one critical component of success for all alternatives is landscape maintenance. The maintenance regime will dictate the ultimate success of native plant establishment. The use of blower machines should be eliminated to reduce the associated airborne spreading of non-native seeds. Care would be needed for the installation and maintenance of a temporary drip irrigation system for all plants transplanted from pots. Removal of exotic species such as *Arundo donax*, Fountain Grass, Tree Tobacco, fan palm, and other species also would be essential for achieving the target habitat objectives. Appropriate hand weeding techniques can be cost-effective in encouraging the return of native species from seed, while eliminating exotics that easily recruit by seed. The use of pesticides and herbicides should be strongly discouraged in favor of more natural methods of weed and pest control.

4.2 ALTERNATIVE 1: OPTIMIZE FLOOD STORAGE

Implementation of Alternative 1 would focus on the primary objective of flood storage and involve the excavation of a large volume of soil to create a basin with relatively gentle side slopes. A diversion structure would be constructed on the levee to divert LAR flows into the basin during peak flood conditions for storage and subsequent release back to the river following passage of the peak flows. The basin would be planted to create a habitat distribution along the basin floor and side slopes dominated by the native plant communities coastal sage scrub, perennial bunchgrass, and riparian thicket. A conceptual plan and sections of Alternative 1 are shown in Figure 4.1 and Figure 4.2, respectively. The various project components are described below.

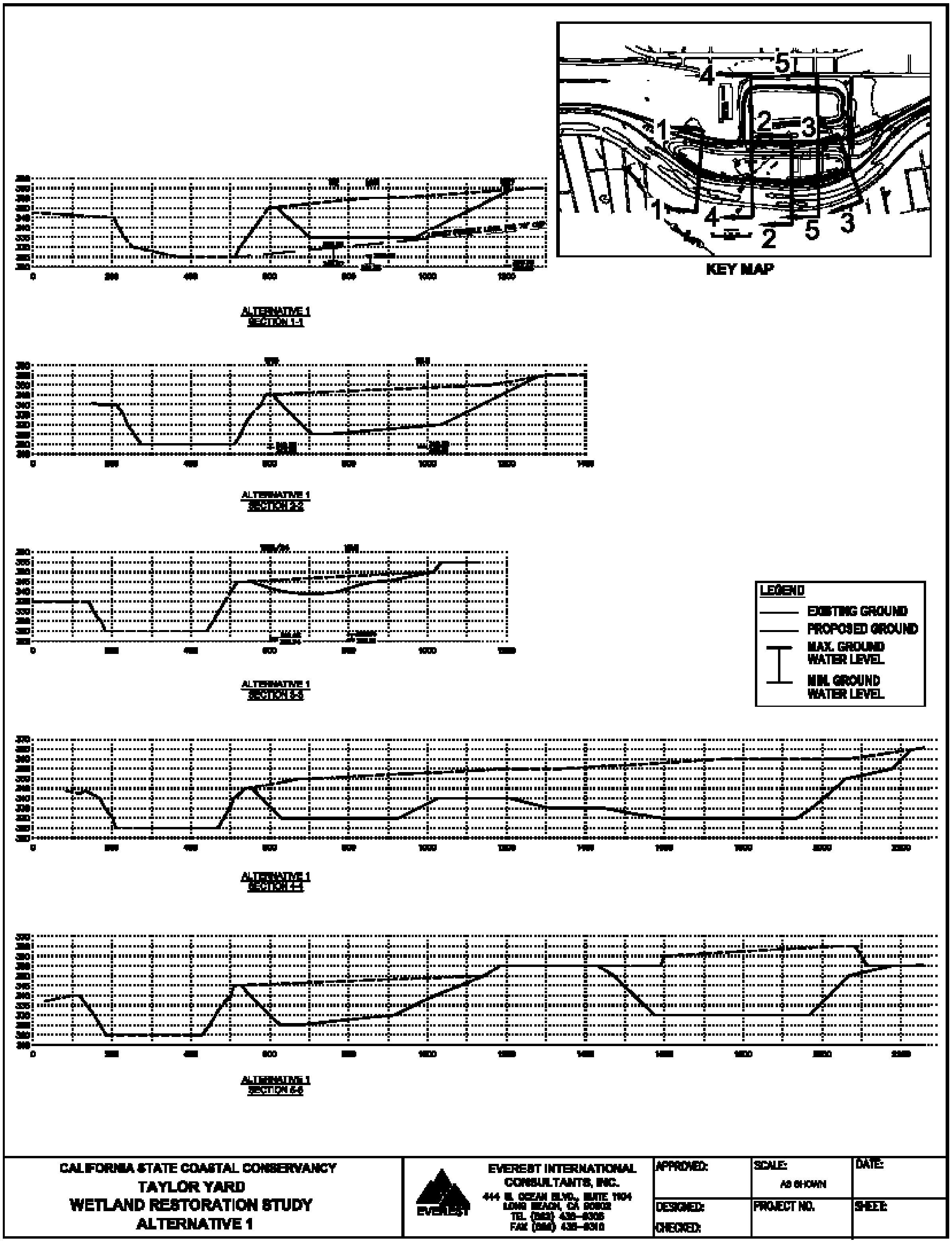
4.2.1 Recreation

To optimize flood storage, Parcel D would be excavated and hydraulically connected to Parcel G to create additional flood storage capacity. The excavated area would be planted with turf grass to provide open space and sports fields. During extreme storm events the basin would be closed to recreational uses until after flood waters subside. The sports field facilities could be left in place or portable facilities that would be removed prior to storm flows could be used to limit flood damage to recreation facilities.

An open channel-type feature would be constructed under the main rail line and a bridge would be built to maintain rail transportation through the site. The open channel would

Figure 4.1 - Alternative 1: Optimize Flood Storage

Figure 4.2 – Alternative 1: Optimize Flood Storage Typical Cross Sections



consist of a berm with a spillway to control water exchange between Parcels G and D. During normal LAR flows and small flood events Parcel D would remain dry. During extreme storms, flood waters would flow from Parcel G into Parcel D after overtopping the berm. After passage of the LAR peak flows, flood waters in Parcel D would flow back into Parcel G and then the LAR through a series of gravity-controlled pipes.

Although Parcel D is shown in an excavated configuration, Alternative 1 could be constructed with Parcel D left at existing elevations (i.e., with little or no excavation). One of the other three Parcel D configurations presented with the other project alternatives could be implemented with Alternative 1. Of course, the additional flood storage associated with excavation of Parcel D would be lost. Detailed discussions regarding the flood storage improvement of the four alternatives can be found in Chapter 5.0 and Appendix B.

4.2.2 Biology

Because extreme flood events could produce high flow velocities that could cause erosion, an emphasis was placed on the use of vegetation at and near the intake structure that would reduce flow velocities near the ground surface. This favors strong, flexible herbaceous and shrub-like woody plants over the development of significant stands of large trees. Physical removal of wetland vegetation would be needed to maintain open water habitat in the wetland center, but this might not be required for the benefit of wildlife habitat. Open water will favor duck species, which are generally common in the Los Angeles basin, while emergent marsh vegetation will favor the rarer, wading birds such as rails, least bittern (*Ixobrychus exilis*), American Bittern (*Botaurus lentiginosos*), moorhen, and song birds, such as Bell's vireo (*Vireo bellii)*, marsh wren (*Cistothorus palustris)*, yellow-breasted chat (*Icteria virens)*, common yellowthroat, song sparrow (*Melospiza melodia)*, tri-colored blackbird (*Agelaius tricolor)* and American goldfinch (*Carduelis tristis)*. Shallow water with standing vegetation would most likely provide greater benefits to water quality improvement than open water lacking emergent vegetation.

The large basin in Parcel G would provide open water wetland habitat. The basin sides would be designed with low-gradient side slopes (0.05 - 0.1) to permit the growth of emergent plants in a shallow reed fringe around the wetland margin. Emphasis was given to a shallow bottom basin capable of supporting an emergent marsh plant community, including bulrushes, cattails (*Typha latifolia),* nutsedge (*Cyperus squarrosus)*, and species of pondweed such as (*Potomogeton natans)*.

Gently sloped sides (0.003 - 0.05) in the basin bottom would provide the maximum area for seasonally moist soils that can support the riparian thicket plant community. Soils should be at least 30% sand to minimize saturated (reduced, non-oxygenated) conditions. Dominant plant species of this community include Arroyo willow, narrow-leave willow, red willow, mulefat (*Baccharis salicifolia),* elderberry *(Sambucus mexicana)* and yerba mansa or lizardtail (*Anemopsis californica)*. Lianas or vines can be grown in this zone using California grape (*Vitis girdiana)*. Trees would be limited to native trees with more open habitat such as California sycamore (*Platanus racemosa*), box elder *(Acer negundo),* and Fremont cottonwood. Willow species can vary in height from tall shrubs (15 ft for Salix *exigua*) to typical tree stature (>30 ft. for *Salix lasiolepis*).

On slopes (0.02 - 0.15) at elevations at or above the annual inundation line, soils are slightly drier and support a range of more drought tolerant plants, such as those in a Sycamore Wash/Riparian woodland community. This zone would not be over-planted or made to be too dense. Native plants appropriate to this zone include California sycamore, elderberry (*Sambucus mexicana)*, California Black Walnut, snowberry (*Symphoricarpos mollis)* and other shrubs native to southern riparian woodland. This zone would provide habitat for downy woodpecker (*Picoides pubescens)*, warbling vireo (*Vireo gilvus)*, Swainson's thrush (*Catharus ustulatus)*, yellow warbler, yellow-breasted chat, black-headed grosbeak, blue grosbeak and American goldfinch.

The upper slopes (0.05 - 0.3) of the flood storage basin would be prime areas for upland habitats, as these slopes would be exposed to full sun and very dry most of the year. The habitat value of the riparian shrub thicket zone would be enhanced by the presence of extensive grasslands on these slopes. Plant species native to southern California bunchgrass habitat that would grow in this zone include nodding needlegrass (*Nassella (Stipa) cernua)*, purple needlegrass (*Nassella (Stipa) pulchra),* deergrass (*Muhlenbergia rigens)*, deerweed (*Lotus scoparius)*, and a suite of annual and perennial wildflowers, such as Checkerbloom (*Sidalcea malvaeflora)*, Sapphire Eriastrum (*Eriastrum sapphirinum)* and Delphinium (*Delphinium spp.)*. Emphasis would be needed to address the impoverished soil conditions resulting from historical site uses, remediating the recontoured soils with native soil bacteria, mycorrhizal fungi and other beneficial micro-organisms. Birds expected to use the restored habitat include western meadowlark, loggerhead shrike, common yellowthroat, and numerous wintering species, including mountain bluebird (*Sialia currucoides*) and various raptors. Recovery of native macro-invertebrates is expected to be challenging, but insects are an important component of the native ecosystem and provide a food source for birds.

The importance of regular, funded maintenance during the establishment phase (typically 2 to 5 years) and in the long-term cannot be overstated. The response of these plants to degraded soil conditions is not known, even with the assistance of soil amendments, such as appropriate soil organic matter, mycorrhizal fungi, and beneficial bacteria. Removal of exotic plant species will remain an ongoing restoration challenge, as has been shown by extensive wetland restoration experience elsewhere in southern California. Funding and program management should address the needs of irrigation, vandalism damage, pest control, and weed removal.

4.2.3 Water Sources

There are several sources of water that could be used to achieve the desired habitat for Alternative 1. Potential sources include the LAR, local runoff, and groundwater. The water sources are discussed in more detail below.

4.2.3.1 Los Angeles River

The LAR would provide water during storm events that overtop the side weir diversion structure along the levee allowing flow into the excavated basin. While this source would provide water for plant species used to infrequent inundation it would not be steady enough to support a permanently ponded wetland habitat. However, treatment of LAR low flows should be possible since the bottom of the basin could be lower than the riverbank at its upstream end so this source of water could be used under Alternative 1. An intake facility through the levee would be needed at the head of the excavated basin. This would allow a permanent wetland to be maintained, albeit of relatively small surface area corresponding to the quantity of diverted flow. The design of this intake structure would need to be adaptable to ensure a balance between the functions of water quality improvement and flood flow storage. Diversion of LAR flows into the basin during low flow conditions would marginally decrease the effectiveness of the basin at providing improved flood storage, because filling the basin with water during lower flows would decrease the storage available during peak discharge when it is most needed.

4.2.3.2 Local Runoff

With some dry season flows and significant wet weather flows, the City-UPRC storm drain that currently empties into the LAR as a 78-inch CMP could provide a source sufficient to support the desired habitat. Of the three major storm drains on Parcel G, this is the only one that crosses through the proposed excavation area. It could be kept in its current alignment by placing it below the proposed excavation area or it could be truncated and modified before reaching the excavation area. Diversion of the City-UPRC drain immediately upstream into the open water area would not be compatible with optimizing flood storage, because either or both of these large-capacity drains could quickly overwhelm the wetland storage capacity prior to arrival of the LAR flood wave.

A modification suggested for further consideration is to redistribute the flow from the City-UPRC drain through an exfiltration gallery running along the east side of the wetland excavation. The use of an exfiltration gallery is further discussed under Alternative 3 in Chapter 4.4.

Wetland vegetation could improve the water quality of this water source or it could be used to polish any pumped water from the Glendale STP. Treated effluent could be taken either directly from the treatment plants or from LAR low flows, about 88 percent of which is tertiary treated effluent from the two upstream treatment plants. The basin would require supplementary irrigation in extremely dry years. Reclaimed water from the City's municipal system could be used for this purpose; however, it would probably be more cost-effective to use treated local groundwater than to divert low flows from the LAR.

It is unlikely that the bottom of the excavated basin could remain above the groundwater level and still be deep enough to accept gravity inflow from the LAR at low flows. If both these conditions were required, further investigation would be needed to verify groundwater level variability and to establish the viability of raising low flows in the river (at the excavated basin intake) with a low weir across the LAR channel to bring the water level as high as necessary to ensure gravity flow from the river into the excavated basin.

4.2.3.3 Groundwater

Based on groundwater well records, the groundwater elevation at the northern end of the project site varies from about 321 feet above MSL to 329 feet, MSL (ERM, 2000a). The basin would be excavated to an elevation of about 325 feet, MSL, which is approximately the average elevation of groundwater in the basin area. Continual contact with groundwater would provide sufficient quantities of water to maintain several types of wetlands habitat. The water elevation in the basin would fluctuate throughout the year similar to the seasonal variations in groundwater elevation.

Depending on the potential toxicity of contaminated groundwater to the target wildlife, it might not be possible to expose groundwater. In this case, it might be necessary to over excavate the basin, lay an impermeable liner beneath the basin, and then backfill the basin with clean topsoil. There is a risk that the liner could be lifted by a combination of exceptionally high groundwater and low basin water levels. This risk could be lowered by raising/replenishing the basin water level with surface water from the City-UPRC drain and delivering it to the basin through an exfiltration gallery located above the liner.

4.2.4 Engineering

This alternative would require the excavation and disposal of approximately 2.7 million cubic yards of soil (Parcels D and G combined). This volume includes a five-foot soil layer below proposed finished grade, which would be replaced with clean, more suitable soil for the restored habitats. Because of the large volume of excavated soil, it would be difficult to provide adequate space to remediate the excavated soil on site to levels suitable for disposal. The excavated soil would likely be hauled to an offsite remediation facility. The soil would be transported via truck, rail, or a combination of truck and rail.

The side weir that would be constructed along the upstream section of the LAR flood control levee would be approximately 500 feet long and 7 feet deep as measured from the top of the levee. The weir would be constructed of concrete in a trapezoidal cross-section configuration. The existing service road that runs along the levee would be left in place through the weir or a bridge could be constructed along the top of the levee to maintain the existing elevations of the service road as well as the pedestrian and bike trail.

Due to the relatively deep elevation of excavation, most of the existing utilities that cross the project site would have to be protected in place or relocated under this alternative. The City-UPRC drain will have to be relocated beginning at Parcel G. The electric transmission lines would be protected in place along the current alignment of the levee. A portion of the MTA maintenance facility road would most likely have to be relocated along the eastern boundary of the main rail line and a new undercrossing would have to be constructed farther south. An example of one possible realignment is shown in Figure 4.7 for Alternative 4. All the utility cables would have to be lowered in elevation or relocated farther east, possibly along the eastern side of the main rail line embankment.

Although the current main rail line alignment would be able to remain once the site is developed, temporary diversion of the rail line would be necessary during construction of the outflow pipes, berm, spillway, and railroad bridge between Parcels G and D, and possibly the railroad bridge over the new MTA maintenance road undercrossing.

4.3 ALTERNATIVE 2: OPTIMIZE HABITAT DIVERSITY

Alternative 2 would require the excavation of a moderate volume of soil to achieve the objectives of optimizing habitat diversity and providing for a modest volume of flood storage.

Such an approach could provide emergent wetland habitat set in a context of gentle gradient slopes around the wetland basin, with steeper slopes above the moist zone. Irregular topography would permit a configuration of terraces and bluffs for a variety of exposures and slight drainage features for variations in soil moisture. Over time, this surface irregularity, combined with soil amendments, would increase the likelihood that the target native plant species would be able to regenerate onsite in the future. A conceptual plan and sections of Alternative 2 are shown in Figure 4.3 and Figure 4.4, respectively. The various project components are described below.

4.3.1 Recreation

Parcel D would be left near existing elevations under Alternative 2. The soils in the area would be remediated to levels suitable for recreational land uses if the level of prior remediation was deemed insufficient for this land use. The site would be cleared and graded following soil remediation. Soccer field, basketball courts, baseball diamonds, and tennis courts would be constructed in Parcel D. The fringe areas would provide picnic areas, trails (oak/sycamore woodland), and parking. A wildlife viewing platform would be constructed along the fringe of the newly restored habitat area (Parcel G) to provide recreational (e.g., bird-watching) and educational (e.g., student tours) opportunities.

4.3.2 Biology

The primary objective of Alternative 2 was to optimize habitat diversity. Habitat diversity implies not only high topographic variation, but also greater levels of effort in planting, irrigation, and maintenance. After slopes have stabilized and soils have become more biologically active, the restoration area will need long-term care to remove exotic species and litter, as well as replace plant losses. The target habitats presented in Table 4.2 were identified to develop a restoration area with a large diversity of habitats.

Distribution of the plant communities around the restored basin would follow expected moisture gradients. That is to say, those plants requiring the most moisture would be situated at or near the lowest elevations. Emergent marsh is the strongest feature of the surface water zone, surrounded by dense, shrubby riparian thicket, in part, and by tree-dominated riparian woodland only where appropriate. These zones border the more arid perennial bunch grassland and coastal sage scrub communities on the upper basin slopes.

The largest area of the basin under Alternative 2 would be dominated by perennial bunch grassland, which intergrades in southern California coastal eco-regions with Opuntia scrub at the arid end of the moisture regime (Benson, 1969) and walnut woodland at the moist end (Raven *et al*, 1986). Perennial bunch grass would be well suited to the dry slopes under all project alternatives. It could intergrade with Opuntia sage scrub and coastal sage scrub toward the top of the basin. The presence of extensive perennial bunchgrass near the riparian woodland greatly would enhance the habitat value of the basin for many bird, mammal, reptile, and invertebrate species. Small areas of cactus coastal sage scrub could be planted along the tops of the slopes where moisture levels would be the most challenging.

Table 4.2 - Los Angeles Basin Lowland Habitats in Need of Recovery

1. Emergent freshwater marsh, with cattails and bulrushes in standing water
2. Riparian woodland (i.e., Sycamore Wash)
3. Riparian scrub, riparian thicket (e.g., Mulefat *Baccharis salicifolia, Salix spp, Sambucus, etc*)
4. Riparian woodland with dense, native understory
5. Riparian woodland near extensive grassland
6. Open expanses of grassland with few or no shrubs
7. Alluvial Fan Scrub, over deeply drained rocky/sandy soils
8. California Sage (*Artemisia californica*)-dominated Coastal Sage Scrub
9. Opuntia sage scrub (*Opuntia* spp.)
10. Walnut woodland (*Juglans californica*) and associates
11. Natural riverbanks or simulated substrate (e.g., excavated basins)
12. Dead trees or nest boxes around standing water

Source: Cooper, 2000.

Large, partially submerged boulders could be used as rock outcrops to increase both slope stability and to improve landscape aesthetics. The outcrops would provide sun and shade niches for reptiles. Further engineering work would be needed to identify how to incorporate large rocks into the proposed project landscape. Nesting boxes could be installed to encourage breeding use by targeted bird species. Habitat for invertebrates will require research to identify structural and functional relationships among invertebrate species and their host plant species. Including native California insects in project planning and design will enhance biodiversity goals.

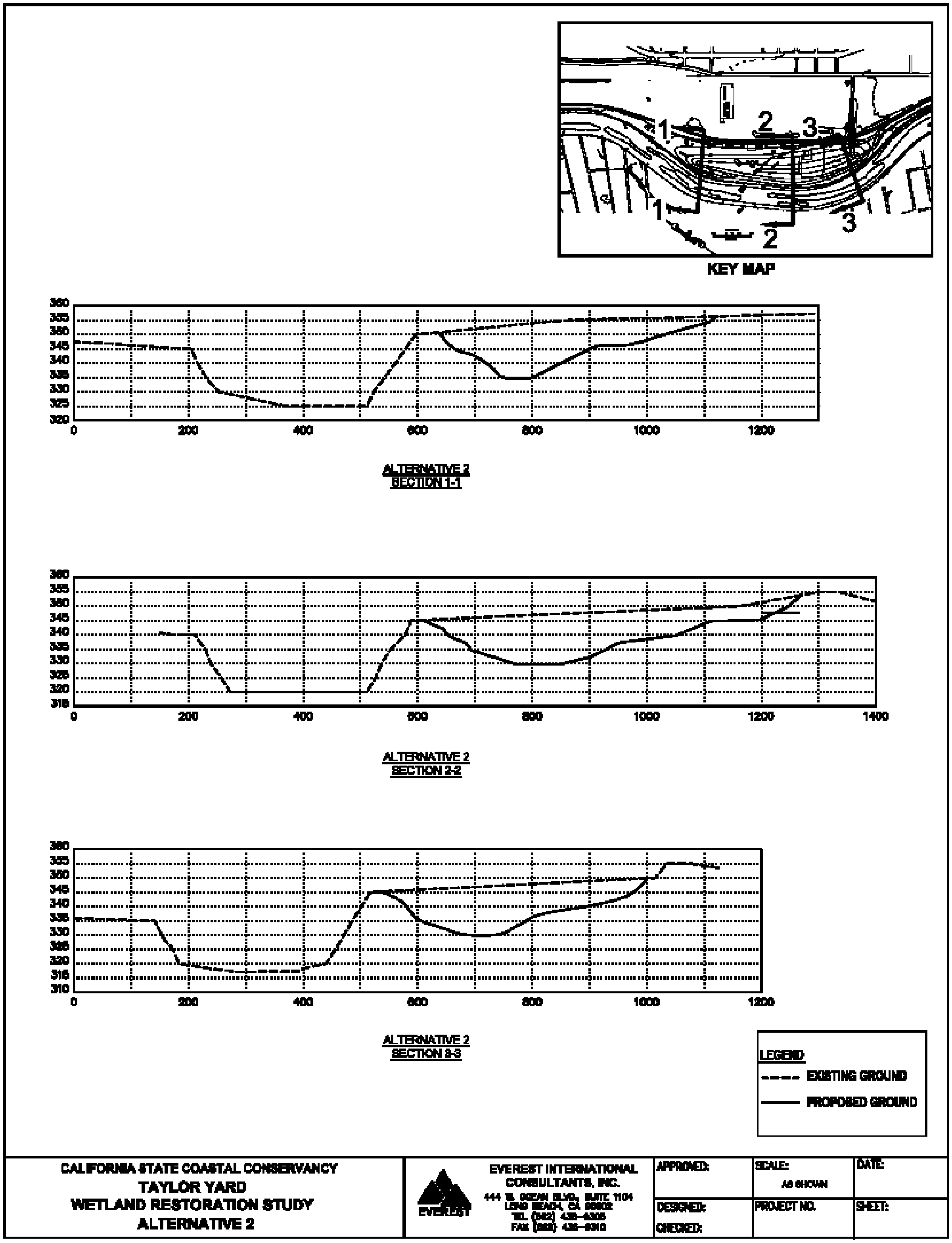
4.3.3 Water Sources

Many of the water source options described in Alternative 1 could be used under Alternative 2, with the exceptions of groundwater and treated LAR low flows. With a bottom elevation at about 330 feet MSL, the proposed excavation would not be deep enough to meet all but the highest groundwater elevations. In the same way, the high bottom elevation would prohibit gravity flow from the LAR low flow channel. However, the City-UPRC drain would probably be exposed and could be truncated as described under Alternative 1.

- Treatment wetlands could be constructed at the upstream portion of the site through excavation of a series of wetland cells. The wetlands could be used to improve the quality of local runoff from the City-UPRC drain. Alternatively, the treatment wetlands

Figure 4.3 - Alternative 2: Optimize Habitat Diversity

Figure 4.4 – Alternative 2: Optimize Habitat Diversity Typical Cross Sections



could be used to treat LAR low flows pumped into the restoration area to maintain the newly created habitat. The water would be returned to the LAR at the downstream end of the restoration area via gravity flow or pumping.

4.3.4 Engineering

This alternative would require the excavation and disposal of approximately 1.0 million cubic yards of soil. This volume includes over-excavation of a five-foot layer, which would be replaced with clean, more suitable soil for the restored habitats. The excavated soil would either be remediated on-site to levels suitable for disposal at other locations or the soil would be hauled to an offsite remediation facility. The soil would be transported via truck, rail, or a combination of truck and rail.

The side weir that would be constructed along the upstream section of the LAR flood control levee would be approximately 500 feet long and 7 feet deep as measured from the top of the levee. The weir would be constructed of concrete in a trapezoidal cross-section configuration. The existing service road that runs along the levee would be left in place through the weir or a bridge could be constructed along the top of the levee to maintain the existing elevations of the service road.

Due to the relatively deep elevation of excavation, most of the existing utilities that cross the project site would have to be protected in place or relocated under this alternative. The City-UPRC drain would be relocated beginning on the east side of Parcel G. The electric transmission lines would be protected in place along the current alignment of the levee. If necessary, a portion of the MTA maintenance facility road could be relocated along the eastern boundary of the main rail line and a new undercrossing could be constructed farther south (Example of new underpass placement shown in Figure 4.7). Alternatively, the MTA maintenance facility road could be left in place and the restoration area could be scaled back to accommodate this existing road. All the telecommunications cables would have to be lowered in elevation or relocated farther east, possibly on the eastern side of the main rail line embankment.

4.4 ALTERNATIVE 3: OPTIMIZE UPLAND HABITAT

Alternative 3 was developed to optimize the upland habitats that have been largely eliminated in the lowland Los Angeles Basin, to minimize soil excavation, reduce contaminant remediation responsibilities, and minimize issues related to water rights. Alternative 3 would involve minor excavation and grading of the surface soil to introduce topographic irregularities and reduce soil compaction. Slopes would vary from almost flat to steep; however, slope parameters would not be critical for this alternative because the plant communities under consideration are well adapted to a range of slopes. A conceptual plan and sections of Alternative 3 are shown in Figure 4.5 and Figure 4.6. The various project components are described below.

4.4.1 Recreation

Parcel D would be left near existing elevations under Alternative 3. The soils in the area would be remediated to levels suitable for recreational land uses and reused onsite. The site would be cleared and graded following soil remediation. Open meadow and turf areas would be constructed in the middle portion of Parcel D for seasonal use as sports fields. The fringe areas would provide picnic areas (walnut woodland), trails (oak/sycamore woodland), and parking.

Under Alternative 3, Parcel G would feature increased public access using a well-marked trail system. The landscape design would provide for a nature center with an environmental landscape demonstration area to educate the public on the value of landscaping with native plants. In order to control access to fragile habitat areas, the habitat area would be fenced off and guided public tours would be staged from the nature center to provide public access.

4.4.2 Biology

The plant communities for this alternative would include perennial bunchgrass, California sage-dominated coastal sage scrub, Opuntia sage scrub (*Opuntia* spp.) and the southern Chaparral shrub community. Walnut woodland may be appropriate for the lower elevations near the river. The herbaceous component of these communities contains a wide diversity of wildflower species, which would provide nesting, foraging and cover for many invertebrates including butterflies, as well as reptiles such as native lizards, salamanders, and snakes. These animals provide important ecosystem functions, which are largely absent from urban Los Angeles, except for a few super-abundant species, such as the western fence lizard.

For both aesthetic and ecological values, the use of large boulders complements the theme of biodiversity in the arid landscape. Rock and pebble mulches would be appropriate under some circumstances to protect soil moisture. These mulches would provide good substrate for wildflowers such as *Clarkia*, *Oenothera* and others, which provide good butterfly foraging habitat. Opportunities to enhance bird nesting habitat could be used in this alternative, by including the structural features beneficial to the optimal target group of bird species. Invertebrates should be included in habitat diversity planning efforts.

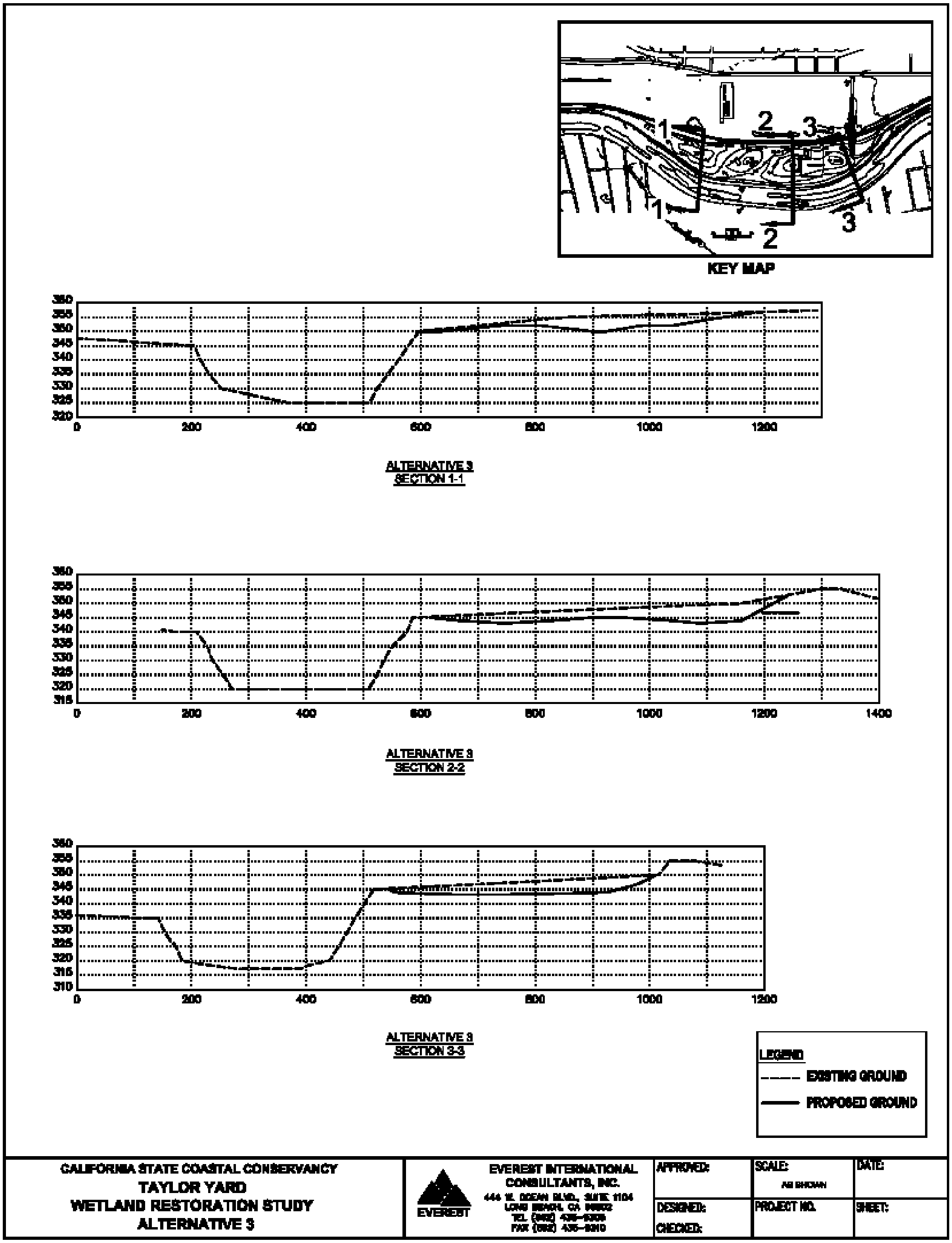
4.4.3 Water Sources

Alternative 3 was developed around direct precipitation as the primary source of water. Irrigation would be needed initially to establish the target plant communities, however, long-term plant values would be maintained by precipitation and local runoff. Owing to the limited amount of excavation and reliance on direct precipitation, this alternative should minimize potential permitting issues related to water rights and water quality impacts.

With some dry season flows and significant wet weather flows, the City-UPRC storm drain that currently empties into the LAR, could be used as a water source. The drain could be truncated and modified before reaching the excavation area. One possible modification would be to redistribute the local runoff through an exfiltration gallery running alongside and a safe distance from the east side of the basin. An exfiltration gallery would be the equivalent of a porous pipe wrapped in filter cloth and surrounded by biologically-active sand

Figure 4.5 - Alternative 3: Optimize Upland Habitat

Figure 4.6 – Alternative 3: Optimize Upland Habitat Typical Cross Sections



and gravel. The gallery would be set at such a level to allow water to be cleansed while seeping through the filter cloth and active sand. Flows during high discharge would likely need to be throttled down using one or more vortex valves, which induce the pipe to fill to maximum capacity, thereby utilizing the maximum storage volume within the pipe. Assuming a constant pipe flow of 130 cfs, 18,000 cubic yards or 1.8% of the total excavated volume would be discharged into the basin during a one-hour period. A gallery 2,400 feet long, 3 feet in diameter would need an exfiltration rate of less than 0.5 inches per second to pass 130 cfs. This could be installed around the basin to achieve maximum residence time.

Alternative 3 would not provide any improvement in flood storage nor would it provide restored wetland habitat. The restored habitat under Alternative 3 would not provide any meaningful improvement in water quality for local runoff. Although there would be no flood storage improvement, Alternative 3 could be viewed as the first phase of implementation for the other alternatives.

4.4.4 Engineering

This alternative would require the excavation and disposal of approximately 0.5 million cubic yards of soil. This volume includes over-excavation of a five-foot layer, which would be replaced with clean and more suitable soil for the restored habitats. The excavated soil would either be remediated onsite to levels suitable for disposal at other locations or the soil would be hauled to an offsite remediation facility. The soil would be transported via truck, rail, or a combination of truck and rail.

Unlike the other alternatives, the proposed grading of Alternative 3 would require only shallow excavation and the finished grade would be above the existing groundwater elevations. To avoid possible groundwater contamination, a geosynthetic clay liner would be installed below the five-foot layer of topsoil in order to separate the restored wetland from groundwater.

The City-UPRC drain would be intercepted with an exfiltration gallery. The treated storm water would then be discharged (via a pump if necessary) into a treatment wetland located in Parcel G.

Due to the relatively shallow level of excavation, most of the existing utilities that cross the project site would not be impacted under this alternative. The electric transmission lines would continue along the existing alignment of the levee. The MTA maintenance facility road would be relocated along the eastern boundary of the main rail line and a new undercrossing would be constructed farther south along the rail line. Alternatively, the MTA maintenance facility road could be left in place and the restoration area (i.e., nature center and restored habitat) could be scaled back to accommodate this existing road.

4.5 ALTERNATIVE 4: NATURALIZE RIVER EDGE (LEVEE REMOVAL/RELOCATION)

Under this alternative, the levee would be removed along the 4,000-foot length of the parcel. The levee would be relocated in function along the main rail embankment as needed to maintain existing levels of flood protection. The restoration area would be excavated at a relatively constant slope from the riverbed up to the toe of the main rail line embankment. The increased width of the river channel associated with implementation of this alternative would be expected to decrease the velocity and water elevation of the LAR in the vicinity of Taylor Yard. A hydrodynamic modeling analysis was conducted to analyze the impact of this alternative on LAR flows and the major findings are discussed in Chapter 5. A more detailed assessment can be found in the modeling study report prepared by PWA (Appendix B).

At and below the average annual water surface elevation, the toe of the slope would be protected from river flow scour using biotechnical bank stabilization. At this point in the planning process, the best recommendation would be a brush layer method (Schiechtl & Stern, 1998). This dense brush layer would be horizontally integrated into the bank structure to produce a stable zone of no-shear stress at the slope toe. Dense woody stems would break up any helical flow hydraulics and produce a thick ‘no-slip’ hydraulic boundary to prevent particle entrainment. A conceptual plan and sections of Alternative 4 are shown in Figure 4.7 and Figure 4.8. The various project components are described below.

4.5.1 Recreation

Parcel D would be left near existing elevations under Alternative 4. The soils in the area would be remediated to levels suitable for recreational land uses. The site would be cleared and graded following soil remediation. Soccer fields, football fields, basketball courts, baseball diamonds, and tennis courts could be constructed throughout Parcel D. The fringe area would provide parking and a community center would be constructed near the parking area to provide indoor recreational uses (e.g., arts and crafts, basketball, volleyball, and community meeting hall).

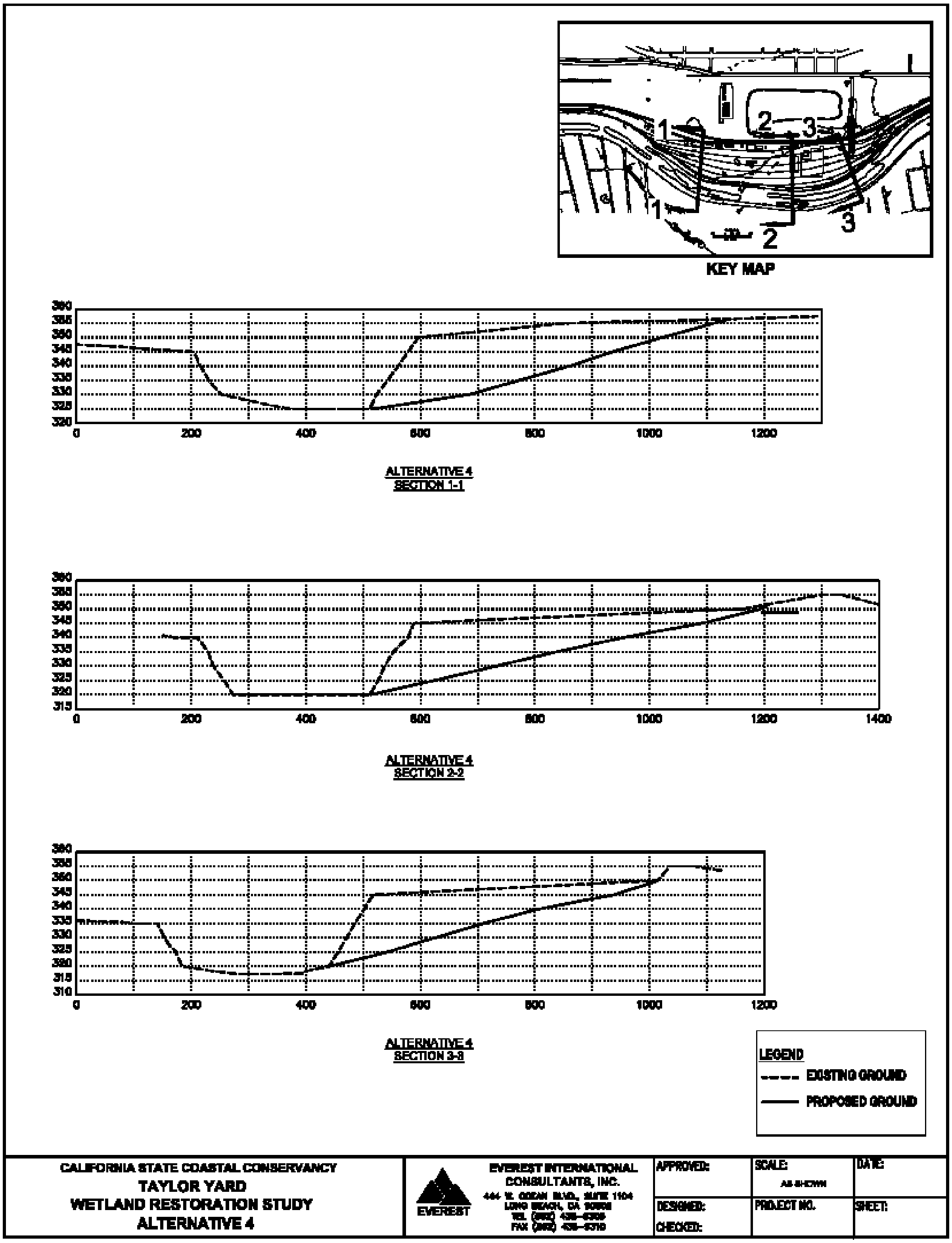
Under Alternative 4, public access to Parcel G would be limited to low-use trails located within the restored area and a high-use trail along the eastern boundary of the property. Scenic view overlooks could be provided along the high-use trail. The landscape design could provide for a nature center with an environmental landscape demonstration area to educate the public on the site history, native flora, and local fauna as well as the value of landscaping with native plants.

4.5.2 Biology

This alternative offers the best opportunity for floodplain restoration. A widened river channel would support extensive riparian thicket and riparian woodland (e.g., cottonwood gallery forest). Perennial bunchgrass, coastal sage scrub, Opuntia sage scrub, walnut woodland, and oak/sycamore woodland would grade upslope from the riverbed towards the main rail

Figure 4.7 - Alternative 4: Naturalize River Edge (Levee Wall Removal)

Figure 4.8 – Alternative 4: Naturalize River Edge (Levee Wall Removal) Typical Cross Sections



line embankment. This range of habitat types in near proximity improves upon the value of any one habitat in isolation. Adequate area given to each habitat type is important to obtain ecosystem functional values.

The alluvial fan scrub community could be a feasible target for recovery at Taylor Yard under Alternative 4. Alluvial fan scrub has very different hydrological requirements than those of other communities. It has an association with deep alluvium, a mix of large boulders with medium-sized and small-sized rock particles, which permits extensive drainage. This group of plants tolerates long periods of drought (10 months or more) followed by flash flooding and inundation for short periods (hours to days). Alluvial fan scrub includes species such as *Yucca whipplei* and *Lepidospartum squamatum*, which are extremely resilient to flood flow shear stress.

These plants are especially well adapted to the conditions that could occur on the back of the removed levee. Where large boulders are interspersed with extensively draining gravels on the back of the levee, this slope would be dry for long periods. A field survey would be needed to determine the range of slopes supporting alluvial fan scrub, especially in wash areas with deep gravel pits. The critical range of slope stability is likely to be fairly steep (0.30 and greater). Data are needed to determine the gradients and substrates these plants are known to inhabit. The woody species of alluvial fan scrub should be considered for biotechnical bank stabilization in this zone to increase slope stability, bank cohesion, flow resistance, and the height of the boundary layer above the boulder armor. These species would greatly enhance the wildlife habitat values for a reconfigured LAR on slopes that would remain dry for more than 10 months per year.

4.5.3 Water Sources

This alternative allows for an increase in the on-line storage and flow capacity of the LAR, reducing the average velocity of flow through the affected reach. Clearly, it would be the closest to the restoration of a natural riverbank and floodplain, although the latter is very constrained compared with its original state. The LAR and direct runoff would provide the water source for habitat restoration along the newly restored riverbank. Design for the flows supporting Alternative 4 would have to incorporate the future water use management plans developed by the ULARA Watermaster.

4.5.4 Engineering

This alternative would require the excavation and disposal of approximately 1.3 million cubic yards of soil. This volume includes a five-foot soil layer below proposed finished grade, which would be replaced with clean and more suitable soil for the restored habitats. The excavated soil would either be remediated onsite to levels suitable for disposal at other locations or the soil would be hauled to an offsite remediation facility. The soil would be transported via truck, rail, or a combination of truck and rail. The existing levee on the east bank of the river would be removed and rebuilt further east along the northeast border of Parcel G. The relocated levee would be relatively shallow; however, and additional studies would be needed to determine the depth of the levee toe.

Due to the relatively shallow level of excavation in the vicinity of existing utilities that cross the project site, most of them would not be impacted under this alternative. However, the City-UPRC drain would have to be truncated where it becomes exposed under the proposed grade. The electric transmission lines and their supporting towers would have to be relocated to the new levee along the northeast border of Parcel G. The MTA maintenance facility road would be relocated along the eastern boundary of the main rail line and a new undercrossing would be constructed farther south along the rail line.

5. ALTERNATIVE EVALUATION

5.1 APPROACH

5.1.1 General

The feasibility of implementing the four alternatives presented in Chapter 4.0 was evaluated to develop specific conclusions (Chapter 6.0) and recommendations (Chapter 7.0) for project implementation. The specific areas of evaluation consisted of recreation, hydrology and hydraulics, biology, water quality, soil and groundwater contamination, environmental impacts and regulatory issues, and cost estimates. The approach used to evaluate each area is presented below and the evaluation for each alternative is presented in Sections 5.2 through 5.5.

5.1.2 Recreation

In general, the evaluation of recreational facilities for each alternative was based solely on Parcel G since any of the recreational improvements presented for Parcel D could be implemented under the four project alternatives and those improvements will be developed by others (e.g., DPR). The exception to this approach is the Parcel D recreational configuration shown for Alternative 1, which would involve a substantial volume of additional excavation that would increase remediation and disposal quantities and cost. The benefits and impacts associated with the other three Parcel D configurations would be similar so they were not evaluated in the present study. Earlier studies identified the need for active recreational uses (e.g., sports fields) in the area and it was assumed that the creation of these facilities on Parcel D would be sufficient to meet the active recreation needs of the local community. The recreation facilities for Parcel G were evaluated for each of the four alternatives. Since no quantitative passive recreational objectives were developed for Parcel G as part of this project, the evaluation was limited to an identification of the recreation components provided by each alternative.

As a compliment to community recreation, the development of Parcel G could incorporate two additional areas in which the community at large can participate. Public art integrated with the spaces dedicated to habitat restoration, could be located along paths and trails. The point of departure for generating public art works could be ecological and environmental issues, and the art could serve as landmarks/signage as well as educational tools. A nature center, incorporating an educational component, could link to programs of continuing education. Displays depicting the LAR history could be included in the mix of recreational uses and the site could share space with classrooms and research facilities. These complimentary activities could be implemented under all four alternatives, complementing the proposed wildlife viewing platforms.

5.1.3 Hydrology and Hydraulics

The flood storage improvement of Alternatives 1, 2, and 4 was evaluated based on the results of a study performed by Philip Williams Associates, Ltd. (PWA, 2001). Alternative 3 was not modeled because no hydraulic connection between the restored area and the LAR was proposed for that alternative. A one-dimensional hydrodynamic model was used to conduct flood flow simulations for the three alternatives under the 5-year, 10-year, 50-year, and 100-year flows through this section of the LAR. In addition, simulations for the 100-year event were conducted for a hypothetical program featuring nine restoration projects similar to Alternative 1 located along the LAR. This hypothetical program was evaluated to determine how many projects similar (in scope and size) to Taylor Yard would be needed to provide improved flood storage along the LAR, thereby providing significant levels of improvement in flood control. The major findings of the model study are presented below for each alternative as appropriate. The modeling study report is provided in Appendix B.

The model calibration could not be carried out with simulation of present-day conditions relating to the vegetative growth in the channel because of the lack of recent data for high flow events. The increase in cross-section roughness associated with the increase in vegetation might have a significant influence on the flood flow regime and on the effect and design of Alternatives 1, 2, and 4. The effect of the existing channel vegetation would have to be analyzed as part of future planning studies.

The potential water sources for each alternative were evaluated to determine the likelihood of successful habitat restoration. The factors considered in the evaluation consisted of flow reliability and frequency.

5.1.4 Biology

The approach utilized to evaluate the biological components of each alternative involved quantitative considerations from plant and soils ecological sciences, together with qualitative considerations involving social perceptions, community goals, and the willingness of stakeholders to work together.

5.1.4.1 Quantitative Considerations

The quantitative factors that affect the successful recovery of the proposed habitats are listed below.

- soil toxicity levels
- soil texture
- soil depth and subsurface profile
- soil organic matter content
- surface and groundwater hydrology
- depth to groundwater and its variation
- slope
- aspect or solar exposure
- appropriate moisture regime
- maintenance regime

All of these factors must be taken into account in the habitat design phase of the work, and can be managed if treated correctly. Adjacent land uses, especially human impacts, will have strong effects on the success of habitat recovery. Each of the proposed habitats needs to be evaluated during the final design phase against criteria for the above factors to refine the evaluation for successful habitat establishment. Design and implementation of the maintenance regime will have critical impacts on the ultimate success or failure of the habitat recovery process. From a scientific standpoint, there is much uncertainty in the large-scale habitat rehabilitation proposed for the Taylor Yard site. Habitat recovery at Taylor Yard should be approached as a pilot program that will serve as a template for other projects of this kind in the future.

5.1.4.2 Coastal Sage Scrub

Existing conditions demonstrate that Coastal Sage Scrub (CSS) habitat elements can be successfully established on Parcel G. Elements of southern walnut woodland can also be found on the site as of 2001. The soil conditions under which these plant species have become established are not known at this time. Factors likely to influence success include the presence of native soil bacteria and fungi, especially mycorrhizae, the soil-root partners which extend root surface areas and root-nutrient uptake functions. Opuntia sage scrub may be less demanding in site requirements for establishment, as this plant community is typically an expression of more xeric, less hospitable sites.

5.1.4.3 Perennial Bunchgrass

Rehabilitation of bunchgrass habitat has been initiated at a few sites in southern California. These include Malibu Creek State Park and at the Audubon Starr Ranch Sanctuary in Trabuco Canyon, Orange County. Both of these sites were located on clean native soils, where exotic weeds could be removed to favor establishment of the former native plant community. At Solstice Canyon Park in Malibu, bunchgrass restoration experiments were conducted in 1989-1990 using locally native mycorrhizal fungi inoculated on the roots of nursery plants grown from locally native seeds. Such an approach was shown to be cost-effective, as inoculated plants survived the establishment phase with lower water demands than non-inoculated plants, however, the research was not published.

Given the stressed conditions of the soil at Taylor Yard, soil fungi and bacteria will be needed to assist recovery of soil biological functions. Habitat restoration at this site should be treated as a pilot program with adequate funding to determine rate and extent of ecological functions needed to support recovery of the target habitat. Other species besides grasses belong in this habitat type, including annual and perennial herbaceous plants or wildflowers.

5.1.4.4 Riparian Thicket

A dense mass of willow, mulefat, elderberry, and other woody species is characteristic of wetland perimeter zones, which serve as the transition between aquatic and terrestrial ecosystems. These plant species are extremely resilient and tolerant of dynamic ecological conditions. If the soil contaminant issues can be resolved, this plant community will respond with vigor under the alternatives developed for this study. Major issues will focus on hydrology (hydroperiod, drainage, and irrigation), soil texture, and maintenance.

5.1.4.5 Native Plant Biotechnical Bank Stabilization

In Alternatives 1, 2, and 4, zones where flowing water will interact with the land surface are candidate areas for native plant biotechnical bank stabilization. Few examples exist for the use of southern California native plants in biotechnical bank stabilization; however, these design concepts have been applied in diverse ecosystems on most continents (Schiechtl and Stern, 1997). The Taylor Yard project offers a significant opportunity to use native plants as structural elements in riverbank protection, especially under Alternatives 1, 2, and 4. By integrating native woody plants into the project engineering design, the likelihood for success in plant survival and project overall success would be greatly enhanced. This approach should be field tested in a low shear stress environment at the Taylor Yard site for evaluation before being applied as a higher stress structural application.

5.1.4.6 Treatment Wetlands

Treatment wetlands are complex, integrated systems in which plants, animals, flowing water, and the environment interact to improve water quality through duplication of natural wetland processes. Treatment wetlands can become natural environments, which utilize the physical, chemical, and biological processes of the ecosystems found in natural wetlands. In this capacity, constructed wetlands can also provide wildlife habitat. However, constructed wetlands have the potential to become "attractive nuisance" features, such as the Kesterson marsh complex in the Central Valley (Harris, 1991), notorious for its exposure of native waterfowl to high levels of selenium, if not carefully designed and properly maintained.

Treatment wetlands provide functions both in free-water surface and subsurface flow systems. Both types of systems are generally constructed as shallow basins or channels, with a subsurface barrier to limit seepage or groundwater contact. The free-water surface system most closely resembles natural wetlands with water flowing over the soil surface at shallow depths. This type of system usually includes emergent or submergent plants, depending upon depth of the wetland cells. In subsurface flow systems, water is applied to a cell or channel filled with a porous medium such as gravel or crushed rock. The flow rate is regulated so free water does not rise to the surface.

Examples of treatment wetlands for storm water and wastewater effluent can be found throughout the United States. In southern California, the USEPA and USGS have established a treatment wetlands research facility at the Hemet/San Jacinto Regional Water Reclamation Facility, Eastern Municipal Water District. The treatment wetlands industry has matured over the last decade, and many products and services now exist to support urban wetland design, construction, and maintenance. Extensive resources are available to meet the site requirements of the conditions found at Taylor Yard.

Alternatives 1, 2, and 4 contain elements of treatment wetlands for multiple criteria. More information is needed on habitat requirements for the design of wetlands, the role of native plant species and processes of water quality improvement with respect to the other project goals of wildlife habitat and recreation.

More information is needed on the role and processes of water quality improvement with respect to the other project goals of wildlife habitat and recreation. Development of treatment wetlands for water quality improvement at Taylor Yard could be funded as a pilot program, allowing for sound science and adaptive management to guide the structure and management of constructed wetlands. It is unlikely that treatment wetlands can be managed for the multiple objectives of biodiversity and water quality improvement, as water and nutrient loads may create relatively uniform, high stress, eutrophic conditions. Biodiversity is fostered by variation in topographic, edaphic (soils), and trophic (nutrient status) conditions.

5.1.4.7 Qualitative Considerations

A clear statement of the habitat restoration goals is critical to being able to achieve those goals. Clarification of the project goals will require the involvement of a wide range of stakeholders, all of whom can affect the long-term outcome. The project must achieve some kind of consensus about what people want to accomplish, with some significant investment in public education, since it is expected that few people in the area are familiar with local ecology and geomorphic processes. The habitats at Taylor Yard are not likely to achieve a self-sustaining or natural condition, foreseeable within the next 50 years. The project should be approached from the outset as a long-term commitment that will be potentially, extremely rewarding but not without challenges.

5.1.5 Water Quality

Each alternative was assessed for the ability to substantially improve water quality for surface water and/or groundwater. In addition, the quality of the proposed water sources was evaluated based on the specific needs of the targeted habitats for each alternative. This was done to determine if restoration of any of the targeted habitats would be impaired by the water quality of the proposed sources.

5.1.6 Soil and Groundwater Contamination

The feasibility of using the various soil and groundwater remediation techniques identified in Chapter 3.2.7 was evaluated for each of the alternatives. This information is important for developing the most cost-effective soil remediation and disposal strategy for each alternative. The feasibility of using the various techniques was based on the total volume of excavated soil and assumptions regarding the level of contamination throughout the site.

5.1.7 Environmental Impacts and Regulatory Issues

The major environmental impacts associated with implementation of each alternative were identified to provide an initial assessment of the potential concerns that might be raised during environmental review. The potential impacts could be used in preliminary engineering to develop mitigation measures that might be needed to offset any significant environmental impacts (e.g., construction equipment modifications to lower air emissions).

Some of the major regulatory issues that would have to be addressed for implementation of each alternative were identified to guide future studies and agency coordination efforts. The regulatory issues focus on water rights, soil remediation, groundwater remediation, and water quality due to the complication of soil and groundwater contamination. In addition, the typical regulatory issues involved in most habitat restoration projects (e.g., streambed alteration agreement, Section 7 biological consultation, Section 404 permit, etc.) would have to be addressed for implementation of any alternative, except possibly Alternative 3.

5.1.8 Construction Cost Estimates

A range of construction cost estimates was prepared for each alternative to assist in gauging the level of funding needed for project implementation. The estimates for the most significant items (e.g., soil excavation, remediation, and disposal) were based on quantities and unit costs. Less significant cost items (e.g., relocation of cable utility lines) were based on quantities and unit costs if available or lump sum allowances. Based on the limited level of site data, a 25 percent contingency was applied to all cost estimates. In addition, the cost estimates include lump sum allowances for preliminary engineering, remediation studies, environmental review (CEQA/NEPA), engineering design, permitting, construction management, environmental construction monitoring. These costs represent order-of-magnitude estimates provided as “place holders” for future project planning. The cost estimates do not include land acquisition, permitting, groundwater cleanup, post-construction monitoring and maintenance.

Costs for bulk transportation and disposal of contaminated soil from Taylor Yard were developed from interpretation of the soil samples collected and analyzed by others. Costs were prepared for five options based on the contaminant types and levels. The following assumptions were used to prepare the unit costs presented below.

1. A minimum of 500 tons of contaminated soil would be excavated and transported for disposal.
2. Unit cost estimates include the cost for trucking with restrictions on loading and unloading timeframes.
3. The current in situ soil vapor extraction system now in operation will remove VOCs from the vadose portion of the soil. Therefore, VOCs in shallow soil will not be problematic for onsite treatment or disposal.
4. The soil to be excavated and removed will be treated and/or transported for disposal.
5. Precise characterization of the soils on Taylor Yard cannot be completed at this time because the material has not been analyzed according to specifications for waste designations. The soil was not analyzed either at an adequate frequency or at all for the following: 1) soluble factions of organic and inorganic compounds, 2) semivolatile organic compounds, 3) polychlorinated biphenyls, 4) 96-hour aquatic assay, 5) total organic halides, and 6) flashpoint, sulfide and cyanide. These analytes are specifically required for waste designation as hazardous, nonhazardous, and Class I, II, or III classification. According to agency regulations, the sampling protocol for waste designation should be outlined in a site-specific work plan established according to the guidelines outlined in the USEPA SW-846 Test Methods for Evaluating Solid Waste Physical/Chemical Methods. The agencies also have requirements concerning the number of samples collected for waste designation (e.g., for more than 10,000 cubic yards one sample would need to be collected for every 500 cubic yards). The assessments conducted to date on the Taylor Yard property were not designed to determine if the soil was Class I waste, Class II waste, or Class III waste.

Assuming all appropriate / required analyses are complete, the 5 disposal options are as follows:

5.1.8.1 Option 1: Non-Hazardous Contaminated Soil

This option would be limited to soil containing total petroleum hydrocarbons and non-hazardous metals, VOCs, and SVOCs. The contaminated soil would be excavated and hauled to TPS Technologies, Inc. in Adelanto, California, which is a Class II Facility. The soil would be remediated using thermal treatment/recycling for a transportation and disposal fee of $40 per ton.

5.1.8.2 Option 2: Non-RCRA Hazardous Contaminated Soil

This option would be limited to soil containing total metals that fail state hazardous fish bioassays and the testing must meet land disposal restrictions. The contaminated soil would be excavated and hauled to one of two Class I disposal facilities. The soil would be transported to either Safety-Kleen, Inc. in Buttonwillow, California or to Chemical Waste Management's Kettleman Hills Facility in Kettleman City, California. The soil would be remediated by direct placement in a landfill for a total fee of $64 per ton. Transportation and disposal would cost approximately $63 per ton and there would be a Board of Equalization (BOE) fee of $1.05 per ton.

5.1.8.3 Option 3: RCRA-Hazardous Contaminated Soil

This option would be limited to metal bearing waste failing federal hazardous restriction tests that is suitable for landfill disposal. The contaminated soil would be excavated and hauled to one of two Class I disposal facilities. The soil would be transported to either Safety-Kleen, Inc. in Buttonwillow, California or to Chemical Waste Management's Kettleman Hills Facility in Kettleman City, California. The soil would be remediated by direct placement in a landfill for a total fee of $95 per ton. Transportation and disposal would cost approximately $72 per ton and there would be a BOE fee of $23 per ton.

5.1.8.4 Option 4: RCRA-Hazardous Contaminated Soil

This option would be limited to metal bearing waste failing federal hazardous restriction tests that is not suitable for landfill disposal. The contaminated soil would be excavated and hauled to one of two Class I disposal facilities. The soil would be transported to either Safety-Kleen, Inc. in Buttonwillow, California or to Chemical Waste Management's Kettleman Hills Facility in Kettleman City, California. The soil would be remediated by contaminant stabilization followed by direct placement in a landfill for a total fee of $151 per ton. Transportation and disposal would cost approximately $147 per ton and there would be a BOE fee of $4 per ton.

5.1.8.5 Option 5: RCRA-Hazardous Contaminated Soil

This option would be limited to metal bearing or organic-bearing waste that is not suitable for landfill disposal. The contaminated soil would be excavated and hauled to Safety-Kleen, Inc. in Aragonite, Utah. The soil would be remediated by incineration followed by placement in a landfill for a total fee of $793 per ton. Transportation and disposal would cost approximately $765 per ton and there would be a BOE fee of $28 per ton.

Due to the limited amount of available information regarding site contamination, three categories for remediation and disposal were developed to simplify the cost analysis further. Categories were developed for low levels, moderate levels, and high levels of soil contamination across the entire site. Unit costs ($/cy) were then developed for each of the three soil contamination categories. A description of the three soil contamination categories and associated unit cost estimates are presented below.

5.1.8.6 Low Cost Remediation and Disposal

This remediation and disposal cost would be for predominantly nonhazardous soil that could be handled using the most inexpensive onsite remediation technology and offsite disposal. This would require sufficient onsite area for laydown, treatment and stockpiling of the contaminated soil. This category would require a significant amount of time because the treatment process requires many months. The average transportation cost would be approximately $8/cy.

It is assumed that approximately 70 percent of the material could be treated on site and shipped off site for no cost other than transportation. The onsite treatment would include bioremediation and chemical fixation for a total average cost of $31/cy including offsite transportation. Approximately 20 percent of the soil would be transported offsite for reuse as Class III cover with disposal costs totaling $36/cy. About 5 percent of the material would be disposed of as non-RCRA hazardous waste for direct landfill at $46/cy and the remaining 5 percent would be disposed of as RCRA hazardous waste at $69/cy.

Calculation: (0.70 X $31) + (0.20 X $36) + (0.05 X $46) + (0.05 X $69) = $34.65

This rounds up to approximately $35/cy.

5.1.8.7 Medium Cost Remediation and Disposal

This remediation and disposal cost category would be for predominantly hazardous soil that could be handled for moderate disposal costs with no onsite treatment. This category of contaminated soil would require less time for remediation and disposal than the Low Cost Category. There also would be less land area required for this category.

It is assumed that approximately 15 percent of the material would be removed from the site and disposed of as non-RCRA hazardous waste at $46/cy. Approximately 75 percent of the soil would be removed from the site and disposed of as RCRA-hazardous waste with disposal costs totaling $69/cy. The remaining 10 percent of the material would be disposed of as RCRA hazardous waste at $109/cy.

Calculation: (0.15 X $46) + (0.75 X $69) + (0.10 X $109) = $69.55

This rounds up to approximately $70/cy.

5.1.8.8 High Cost Remediation and Disposal

This remediation and disposal cost category would be for predominantly hazardous soil that would be handled at the highest disposal costs with no onsite treatment. This category of contaminated soil would require less time for remediation and disposal than the Middle Cost Category. There also would be less land area required for this category.

It is assumed that approximately 70 percent of the soil would be removed from the site and disposed of as RCRA-hazardous waste with disposal costs totaling $69/cy. Approximately 15 percent of the material would be disposed of as RCRA hazardous waste at $109/cy. The remaining 15 percent of the material would be disposed of as RCRA-hazardous waste requiring incineration for $568/cy.

Calculation: (0.70 X $69) + (0.15 X $109) + (0.15 X $568) = $149.85

This rounds up to approximately $150/cy.

The costs for the three levels of remediation were used to provide a range in the potential construction cost estimates. The unit costs presented above were based on remediation for human health risk standards; however, excavated soil that will be exposed to wildlife might have to be remediated to more stringent cleanup levels. For example, benthic invertebrates that live in the soil would be more sensitive to contaminant exposure than small mammals. Depending on the nature of the contaminant, exposure pathways, and wildlife organisms, contaminants might bioaccumulate up through the food chain. An ecological risk assessment will be required to determine the remediation levels needed to reduce potential toxicity threats to levels considered insignificant. Therefore, the ultimate unit costs for soil remediation might be higher than those provided above depending on the results of the ecological risk assessment.

5.2 ALTERNATIVE 1: OPTIMIZE FLOOD STORAGE

Implementation of Alternative 1 would yield the greatest improvement in flood storage while restoring a limited mixture of riparian habitats. Because the alternative included the use of both Parcels D and G for flood storage improvement it would involve the excavation, remediation, and disposal of the largest volume of soil, as well as construction of a side weir diversion structure. The alternative would feature the smallest recreational component due to the need to keep people out of the excavated basin during storm events for safety reasons. The alternative would have the highest construction costs; however, it could also provide the greatest overall benefits from the standpoint of flood storage improvement as well as diversity due to habitat restoration, and recreational facility creation. A more detailed evaluation of Alternative 1 is presented below.

5.2.1 Recreation

Alternative 1 would provide active and passive recreation uses on Parcel D and limited passive uses on the fringes of Parcel G. No public access to the interior of the restored basin on Parcel G would be provided because the restored habitat would serve as a flood storage facility during the wet season. The public would be able to view the site from a pedestrian and bike trail that would run along the top of the flood levee. A nature center could be constructed on the southwest corner of Parcel D adjacent to the main rail line embankment. Overlook viewpoints with educational kiosks could be provided to increase public access and educational opportunities.

5.2.2 Hydrology and Hydraulics

Based on the results of the hydrodynamic modeling analysis, the additional flood storage provided by Parcels D and G would lower the peak discharge of the 100-year flood by 3,000 cfs immediately downstream from Taylor Yard. The increased flood storage also would lower the flood water level by 0.6 feet compared to existing conditions (without in-stream vegetation) downstream from Taylor Yard, thereby yielding an improvement in flood elevations within the LAR. The comparison of peak discharges with and without the project is shown in Figure 5.1. The decrease in peak discharge, while an improvement in flood flow conditions along the LAR, would be too small to provide any significant improvements, especially given the relatively high cost. Based on the results of prior studies, it was known that creation of additional flood storage at Taylor Yard would not yield significant improvements in flood control along the LAR so this finding was expected.

The model results indicated that the maximum, average, cross-sectional velocities in the excavated basin could be between 10 feet per second (fps) and 20 fps. These high velocities occur as the flood waters just crest the diversion structure and the water depth is relatively shallow (0.2 ft to 1.5 ft). As flows into the basin increase and the water depth increases to over 2 ft, the average cross-sectional velocities drop to around 5 fps to 8 fps. These results suggest that energy dissipation and scour protection measures would be needed in the area adjacent to the diversion structure just inside the excavated basin.

5.2.2.1 Los Angeles River Floodplain Restoration Program Evaluation

The hydrodynamic model was used to conduct an analysis to determine if implementation of a floodplain restoration program would produce significant improvements in flood storage. The analysis involved simulating 100-year flood flows in the LAR with nine restoration projects identical to Alternative 1 implemented along the LAR at various locations. The nine selected locations are shown in Figure 5.2. Since the analysis was performed as a "proof of concept", the locations were based on hydrodynamic considerations only, with no evaluation of the environmental, engineering, social, or economic factors.

The results of the modeling analysis indicated that implementation of nine restoration projects similar to Alternative 1 would reduce peak discharges by over 21,000 cfs just downstream from Rio Hondo, which is a ten percent reduction over existing conditions (Figure 5.3). The flood water level would be reduced by approximately 1.2 ft and the reduction coincided with the reduction in peak discharge. These results indicate that implementation of a floodplain restoration program featuring nine projects that are similar to Alternative 1 could yield a significant improvement in flood storage along the LAR.

5.2.3 Biology

Alternative 1 provides the best option for extensive floodplain wetland development. The large excavated basin offers more opportunities for constructed wetlands integrated with emergent marsh and riparian thicket around the perimeter than any of the other alternatives. This alternative could provide the greatest extent of connected wildlife habitats. Adjacent habitat types improve the ecological function of the wider system, by providing a mix of nesting, shelter and forage resources. The basin slopes could be adapted, depending on the outcome of the stakeholder involvement process, to provide the optimal mix of coastal

Figure 5.1 - Alternative 1: Peak LAR Discharge Differences Downstream of Taylor Yard

Figure 5.2 - Selected Locations of 9 Comparable Restoration Sites

Figure 5.3 - Los Angeles River Floodplain Restoration Program Evaluation: Peak LAR Discharge Differences Downstream of Rio Hondo

sage scrub and perennial bunchgrass. The approach of reducing public access within the flood storage basin would enhance the ultimate value of the wildlife habitats.

5.2.4 Soil and Groundwater Contamination

Based on the assumption that the existing soil and groundwater contamination would be toxic to some forms of wildlife, implementation of Alternative 1 would probably require complete remediation of excavated soils, offsite disposal of excavated soils, full remediation of groundwater contamination (done by others), and backfilling with clean topsoil suitable for the target plant palette. These requirements would result in relatively large implementation costs for Alternative 1, primarily due to soil remediation and disposal. In addition, full remediation of the groundwater would take decades to achieve so a significant amount of time would be needed to implement Alternative 1 with full exposure of groundwater if it is determined that groundwater contamination is toxic to the target wildlife.

It might be possible to construct Alternative 1 without full remediation of groundwater contamination by installing a contaminant liner to isolate the restored habitat from the contaminated groundwater. Liner design would require a groundwater pumping and drainage system to alleviate the hydrostatic pressures on the liner associated with high groundwater elevations under the liner. The liner and associated pumping system would modify the groundwater flow regime under Taylor Yard, which could result in adverse impacts to the transport of the contaminants beneath Taylor Yard and under adjacent properties.

5.2.5 Environmental Impacts and Regulatory Issues

Implementation of Alternative 1 would result in substantial impacts to the environment under any of the proposed optional configurations. The excavation, remediation, and disposal of up to 2.7 million cy of soil could result in potential impacts to air quality, water quality, and traffic during construction. The diversion of flood flows into the excavated basin could result in adverse impacts to existing infrastructure (e.g., flooding of structures) and habitat (e.g., hydrologic changes) along and within the LAR, respectively. The excavated basin could alter groundwater flow patterns, thereby adversely impacting migration of the contaminants beneath Taylor Yard and under adjacent properties.

Coordination with several regulatory agencies would be needed to implement Alternative 1. The USACE and LACDPW would have to review and approve any modifications to the LAR flood control system to make sure that the proposed project does not increase flood-damage potential. Diversion of the LAR flows (extreme storm flows or low flows) would also involve close scrutiny by the ULARA Watermaster, to make sure there would not be any adverse impacts to water quality and to quantify the consumption of water related to habitat restoration (e.g., evapotranspiration) to determine water use payments to the City. The LARWQCB and USEPA would review the alternative for compliance with water quality requirements for the discharge of any water from the restored habitat to the LAR. The DTSC and LARWQCB would regulate the remediation of contaminated soil and groundwater, which would require adherence to predefined programs and protocols for all remediation activities. The City and DHS would regulate the water quality criteria for any water returned to the municipal drinking or reclaimed water supply.

5.2.6 Cost Estimate

The estimated cost to implement Alternative 1 could range from $198 million to $658 million depending on the level of contaminated soil remediation. Alternative 1 is the only alternative that includes soil excavation, backfilling, and remediation on Parcel D. All other alternatives include costs for Parcel G only. Assuming a medium cost for soil remediation and disposal, the estimated implementation cost of the project could be about $338 million. Earthwork including excavation and fill material as well as soil remediation and disposal comprise 73% to 78% of the total estimated construction cost. The implementation cost estimate based on the medium level soil remediation and disposal unit costs is summarized in Table 5.1. A detailed cost estimate based on a medium level of soil remediation and disposal is provided in Appendix C.

Table 5.1 - Alternative 1 Cost Estimate

Item	Cost Estimate
Construction	**$281,740,000**
Preliminary Engineering (2%)	$5,635,000
Soil/Groundwater Remediation Studies (3%)	$8,452,000
Environmental Review (2%)	$5,635,000
Final Engineering/Design (7%)	$19,722,000
Construction Management (5%)	$14,087,000
Environmental Monitoring (1%)	$2,817,000
Total	**$338,088,000**

5.3 ALTERNATIVE 2: OPTIMIZE HABITAT DIVERSITY

Implementation of Alternative 2 would restore a large diversity of riparian habitats while yielding a modest improvement in flood storage relative to the other alternatives. The alternative would involve the excavation, remediation, and disposal of a significant volume of soil as well as construction of a side weir diversion structure between the LAR and Parcel G. Other water sources could be used to implement this alternative, thereby rendering a diversion structure unnecessary. The alternative would feature a relatively large, mixed recreational component. The alternative would have the third highest implementation cost; however, it would also provide the greatest habitat diversity with limited flood storage improvement and recreation facility creation. A more detailed evaluation of Alternative 2 is presented below.

5.3.1 Recreation

Alternative 2 would provide active and passive recreation uses on Parcel D and limited passive uses on Parcel G. Soccer fields, tennis courts, baseball diamonds, and basketball courts would cover Parcel D. A light-use loop trail would run along the southeastern corner of the restoration area. A multi-use trail would support hiking and bicycling activities along the main rail embankment.

5.3.2 Hydrology and Hydraulics

Based on the results of the hydrodynamic modeling analysis, the additional flood storage provided by Parcel G would lower the peak discharge of the 100-year flood by 1,000 cfs immediately downstream from Taylor Yard, thereby yielding a slight improvement in flood control within the LAR. The corresponding decrease in flood water level was insignificant. A comparison of peak discharges with and without the project is shown in Figure 5.4. The decrease in peak discharge, while an improvement in flood flow conditions along the LAR, would be too small to provide any significant improvements, especially given the relatively high cost. As with Alternative 1, this finding was expected based on the results of prior studies.

The model results indicated that the maximum average cross-sectional velocities in the excavated basin could be between 3 fps and 7 fps. These velocities occur as the flood waters just crest the diversion structure and the water depth is relatively shallow. These results suggest that energy dissipation measures would probably not be needed in the area adjacent to the diversion structure just inside the excavated basin and that only limited measures would probably be needed for scour protection. This alternative might provide an excellent opportunity to demonstrate the viability of biotechnical bank stabilization techniques in Southern California.

5.3.3 Biology

Achievement of biodiversity goals is dependent on overcoming a number of significant obstacles, including potential soil toxicity hazards, excavation requirements, recovery of soil biological functions and public demand for access to open space. This presents a challenging set of demands to balance site design, grading detail, soil biological processes, water balance and irrigation demands, with management of public expectations and demand for recreation access.

Of the four alternatives developed for this study, Alternative 2 is probably the most challenging technically. This is because the approach would require more care than the others at each step of the process. At this point, potential soil toxicity hazards would present the most significant challenges to biodiversity recovery. Remediation of soils would require additional research to identify methods of biohazard decomposition, recovery of soil microbial function (bacteria and fungi), and soil organic matter use (e.g., compost) to encourage growth of native soil invertebrates. Attention to detail in the final grading design would be needed to provide for adequate slope stability and micro-topographic variation, to direct the flow of rainwater into well-defined micro-channels. The use of large rock would be encouraged to hold sediments in place within these channels.

Figure 5.4 - Alternative 2: Peak LAR Discharge Differences Downstream of Taylor Yard

Considering the extent to which coastal sage scrub species have already re-colonized portions of Parcel D, recovery of this plant community is expected to be the easiest to accomplish. Given adequate hydrology and soils, recovery of the plant species of the riparian thicket community is likely to provide an achievable target. These two plant communities (with adequate areal extent) in near proximity to each other would greatly enhance the biological productivity for bird migration.

5.3.4 Soil and Groundwater Contamination

Based on the assumption that the existing soil and groundwater contamination would be toxic to some forms of wildlife, implementation of Alternative 2 would probably require complete remediation of excavated soils, offsite disposal of excavated soils, full remediation of groundwater contamination, and backfilling with clean topsoil suitable for the target plant palette. These requirements would result in relatively large implementation costs for Alternative 2, primarily due to soil remediation and disposal. In addition, full remediation of the groundwater would take decades to achieve, so a significant amount of time would be needed to implement Alternative 2 with full exposure of groundwater, if it is determined that groundwater contamination is toxic to the target wildlife.

It might be possible to construct Alternative 2 without full remediation of groundwater contamination by installing a contaminant liner to isolate the restored habitat from the contaminated groundwater. Liner design would require a groundwater pumping and drainage system to alleviate the hydrostatic pressures on the liner associated with high groundwater elevations under the liner. The liner and associated pumping system would modify the groundwater flow regime under Taylor Yard, which could result in adverse impacts to the transport of the contaminants beneath Taylor Yard and adjacent properties.

5.3.5 Environmental Impacts and Regulatory Issues

Implementation of Alternative 2 could result in substantial impacts to the environment. The excavation, remediation, and disposal of about 1.0 million cy of soil could result in potential impacts to air quality, water quality, and traffic during construction. The diversion of flood flows into the excavated basin could result in adverse impacts to existing infrastructure (e.g., flooding of structures) and habitat (e.g., hydrologic changes) along and within the LAR, respectively. In addition, the excavated basin could alter groundwater flow patterns, thereby adversely impacting migration of the contaminants beneath Taylor Yard and adjacent properties.

Coordination with several regulatory agencies would be needed to implement Alternative 2. The USACE and LACDPW would have to review and approve any modifications to the LAR flood control system to make sure that the proposed project does not increase flood-damage potential. Diversion of the LAR flows (extreme storm flows or low flows) also would involve close scrutiny by the ULARA Watermaster to make sure there would not be any adverse impacts to water quality and to quantify the consumption of water related to habitat restoration (e.g., evapotranspiration) to determine water use payments to the City. The LARWQCB and USEPA would review the alternative for compliance with the water quality requirements for the discharge of any water from the restored habitat to the LAR. The DTSC and LARWQCB would regulate the remediation of contaminated soil and groundwater, which would require adherence to predefined programs and protocols for all remediation activities.

The City and DHS would regulate the water quality criteria for any water returned to the municipal drinking or reclaimed water supply.

5.3.6 Cost Estimate

The estimated cost to implement Alternative 2 could range from $79 million to $254 million depending on the level of contaminated soil remediation. Assuming a medium cost for soil remediation and disposal, the estimated implementation cost of the project could be about $132 million. Earthwork including excavation and fill material as well as soil remediation and disposal comprise 71% to 77% of the total estimated construction cost.. The implementation cost estimate based on the mid-level soil remediation and disposal unit costs is summarized in Table 5.2. A detailed cost estimate based on a medium level of soil remediation and disposal is provided in Appendix C.

Table 5.2 - Alternative 2 Cost Estimate

Item	Cost Estimate
Construction	**$110,299,000**
Preliminary Engineering (2%)	$2,206,000
Soil/Groundwater Remediation Studies (3%)	$3,309,000
Environmental Review (2%)	$2,206,000
Final Engineering/Design (7%)	$7,721,000
Construction Management (5%)	$5,515,000
Environmental Monitoring (1%)	$1,103,000
Total	**$132,359,000**

5.4 ALTERNATIVE 3: OPTIMIZE UPLAND HABITAT

Implementation of Alternative 3 would restore upland riparian fringe habitats with no improvement in flood storage. Alternative 3 was developed as an interim phase of construction for the other three alternatives; however, it could serve as an independent alternative. The alternative would involve the excavation, remediation, and disposal of the least volume of soil compared to the other three alternatives. The alternative would feature a relatively large, mixed recreational component. The alternative would have the lowest implementation cost and rely on direct precipitation and local runoff for water sources. This alternative would provide substantial recreational facilities, however, it would not provide any riparian wetlands habitat restoration. A more detailed evaluation of Alternative 3 is presented below.

5.4.1 Recreation

Alternative 3 would provide active and passive recreation uses on Parcel D and passive uses on Parcel G. Open meadow and turf areas on Parcel D would be converted to soccer fields, baseball diamonds, and football fields as needed. The open meadow and fringe areas on Parcel D would be used for picnicking and similar activities. Light-use loop trails would meander through the various habitats in the restoration area and around the perimeter of Parcel D. A multi-use trail would support hiking and bicycling activities.

Parcel G would feature increased public access using a well-marked trail system. The landscape design would provide for a nature center with an environmental landscape demonstration area to educate the public on the value of landscaping with native plants. In order to control access to fragile habitat areas, the habitat area would be fenced off and guided public tours would be staged from the nature center to provide public access.

5.4.2 Hydrology and Hydraulics

No diversion structure was proposed to connect the restored habitat under Alternative 3 to the LAR. This is because flood storage improvement was not an objective for development of this interim alternative and the proposed excavation was not large enough to provide significant flood storage. For these reasons, Alternative 3 was not analyzed as part of the hydrodynamic modeling study conducted by PWA.

5.4.3 Biology

Engineering design for minor excavation is an important part of this alternative. While lesser amounts of soil would be removed, roughening the surface of the landscape is important to help achieve a more natural variation in slopes and terraces, which influences distribution of water at the micro-site scale.

The plant communities for this alternative would include perennial bunchgrass, California sage-dominated by coastal sage scrub, Opuntia sage scrub (*Opuntia* spp.) and the southern Chaparral shrub community. Walnut woodland may be appropriate for the lower elevations near the river. The herbaceous component of these communities contains a wide diversity of wildflower species, which would provide nesting, foraging and cover for many invertebrates including butterflies, as well as reptiles such as native lizards, salamanders, and snakes. These animals provide important ecosystem functions, which are largely absent from urban Los Angeles, except for a few super-abundant species, such as the western fence lizard.

For both aesthetic and ecological values, the use of large rock and boulders complements the themes of biodiversity in the arid landscape. Rock and pebble mulches would be appropriate under some circumstances to protect soil moisture. These mulches would provide good substrate for wildflowers such as *Clarkia*, *Oenothera* and others, which provide good butterfly foraging habitat.

Opportunities to enhance bird nesting habitat could be used in this alternative, by including the structural features beneficial to the optimal target group of bird species. Invertebrates such as butterflies, beetles and bugs should be included in habitat diversity planning efforts. Irrigation needs for upland species are lower than almost all other plant groups, but are still critical for the establishment phase.

5.4.4 Soil and Groundwater Contamination

Based on the assumption that the existing soil and groundwater contamination would be toxic to some forms of wildlife, implementation of Alternative 3 would probably require remediation and/or excavated soils, offsite disposal of excavated soils, and backfilling with clean topsoil suitable for the target plant palette. These requirements would result in relatively large implementation costs for Alternative 3, primarily due to soil remediation and disposal. Construction of Alternative 3 would probably not require full remediation of groundwater contamination; however, it may be necessary to install a contaminant liner to isolate the restored habitat from the contaminated groundwater.

5.4.5 Environmental Impacts and Regulatory Issues

Implementation of Alternative 3 could result in substantial impacts to the environment. The excavation, remediation, and disposal of about 0.5 million cy of soil could result in potential impacts to air quality, water quality, and traffic during construction. However, the potential environmental impacts associated with Alternative 3 would most likely be less adverse than the other three alternatives.

Coordination with several regulatory agencies would be needed to implement Alternative 3. The DTSC and LARWQCB would regulate the remediation of contaminated soil and groundwater, which would require adherence to predefined programs and protocols for all remediation activities. The LARWQCB and USEPA would review the alternative for compliance with the water quality requirements for the discharge of any water from the restored habitat to the LAR. The City and DHS would regulate the water quality criteria for any water returned to the municipal drinking or reclaimed water supply. However, if the site is not used for water quality treatment (e.g., treatment wetlands) then the LARWQCB, USEPA, City, and DHS would have minimal involvement in implementation of Alternative 3.

5.4.6 Cost Estimate

The estimated cost to implement Alternative 3 could range from $61 million to $173 million depending on the level of contaminated soil remediation. Assuming a medium cost for soil remediation and disposal, the estimated implementation cost of the project could be about $95 million. Earthwork including excavation and fill material as well as soil remediation and disposal comprise 68% to 76% of the total estimated construction cost. The implementation cost estimate based on the mid-level soil remediation and disposal unit costs is summarized in Table 5.3. A detailed cost estimate based on a medium level of soil remediation and disposal is provided in Appendix C.

Table 5.3 - Alternative 3 Cost Estimate

Item	Cost Estimate
Construction	**$79,451,000**
Preliminary Engineering (2%)	$1,589,000
Soil/Groundwater Remediation Studies (3%)	$2,384,000
Environmental Review (2%)	$1,589,000
Final Engineering/Design (7%)	$5,562,000
Construction Management (5%)	$3,973,000
Environmental Monitoring (1%)	$795,000
Total	**$95,343,000**

5.5 ALTERNATIVE 4: NATURALIZE RIVER EDGE (LEVEE REMOVAL)

Implementation of Alternative 4 would restore a portion of the floodplain and associated riparian habitat that existed historically along this stretch of the LAR. This alternative would involve the excavation, remediation, and disposal of a significant volume of soil as well as relocation of a portion of the LAR flood control levee. Alternative 4 would feature a relatively large, mixed recreational component and it would have the second highest implementation cost. A more detailed evaluation of Alternative 4 is presented below.

5.5.1 Recreation

Alternative 4 would provide active and passive recreation uses on Parcel D and passive uses on Parcel G. Soccer fields, tennis courts, baseball diamonds, and basketball courts would cover Parcel D. A light-use loop trail would meander through the various habitats in the restoration area (Parcel G). One or two spurs would provide access to the riverbank. A multi-use trail would support hiking and bicycling activities.

5.5.2 Hydrology and Hydraulics

Based on the results of the hydrodynamic modeling analysis, the additional cross-sectional area provided by channel widening under Alternative 4 would lower the peak discharge of the 100-year flood by 1,000 cfs immediately downstream from Taylor Yard, thereby yielding a slight improvement in flood control within the LAR. The corresponding decrease in flood water level was insignificant. The comparison of peak discharges with and without the project is shown in Figure 5.5. The decrease in peak discharge, while an improvement in flood flow conditions along the LAR, would be too small to provide any significant improvements, especially given the relatively high cost.

Figure 5.5 - Alternative 4: Peak LAR Discharge Difference Downstream of Taylor Yard

The model results indicated that the maximum average cross-sectional velocities would decrease by 2 fps and 5 fps due to the larger cross-sectional area in the river channel. The reduction in river channel flow velocities might make this alternative a good opportunity to demonstrate the viability of biotechnical bank stabilization techniques in Southern California.

5.5.3 Biology

This alternative offers the best opportunity for authentic floodplain restoration. A widened river channel (within a range of channel-floodplain configurations) could support extensive riparian thicket and riparian woodland (e.g., cottonwood gallery forest). Perennial bunchgrass, coastal sage scrub, Opuntia sage scrub, walnut woodland, and oak/sycamore woodland would grade upslope from the riverbed towards the main rail line embankment. This range of habitat types in near proximity improves upon the value of any one habitat in isolation. Adequate area given to each habitat type is important to obtain ecosystem functional values.

The woody species of alluvial fan scrub should be considered for biotechnical bank stabilization in this zone. Biostabilization would be used to increase slope stability, bank cohesion, flow resistance, and the height of the boundary layer above the boulder armor. These species would greatly enhance the wildlife habitat values for a reconfigured LAR on slopes that will remain dry for more than 10 months per year.

5.5.4 Soil and Groundwater Contamination

Based on the assumption that the existing soil and groundwater contamination would be toxic to some forms of wildlife, implementation of Alternative 4 would probably require complete remediation of excavated soils, offsite disposal of excavated soils, full remediation of groundwater contamination, and backfilling with clean topsoil suitable for the target plant palette. These requirements would result in relatively large implementation costs for Alternative 4, primarily due to soil remediation and disposal. In addition, full remediation of the groundwater would take decades to achieve so a significant amount of time would be needed to implement Alternative 4 with full exposure of groundwater if it is determined that groundwater contamination is toxic to the target wildlife.

The option of using a liner to isolate the restored habitat from the contaminated groundwater would not be feasible for Alternative 4. This is because the liner would have to be designed to withstand the hydrostatic forces of the surface water and groundwater forces in the LAR channel. In addition, the liner would have to be constructed such that riverbed scour during high flood flows would not undermine the integrity of the contaminant liner.

5.5.5 Environmental Impacts and Regulatory Issues

Implementation of Alternative 4 could result in substantial impacts to the environment. The excavation, remediation, and disposal of about 1.3 million cy of soil could result in potential impacts to air quality, water quality, and traffic during construction. Modification of the LAR flood control levee could result in adverse impacts to existing infrastructure (e.g., flooding of structures) and habitat (e.g., hydrologic changes) along and within the LAR, respectively.

Coordination with several regulatory agencies would be needed to implement Alternative 4. The USACE and LACDPW would have to review and approve any modifications to the LAR flood control system to make sure that the proposed project does not increase flood damage potential. The restoration of riparian habitat within the LAR would involve close scrutiny by the ULARA Watermaster to make sure there would not be any adverse impacts to water quality. The DTSC and USEPA would regulate the remediation of contaminated soil and groundwater, which would require adherence to predefined programs and protocols for all remediation activities.

5.5.6 Cost Estimate

The estimated cost to implement Alternative 4 could range from $126 million to $360 million depending on the level of contaminated soil remediation. Assuming a medium cost for soil remediation and disposal, the estimated implementation cost of the project could be about $197 million. Earthwork including excavation and fill material as well as soil remediation and disposal comprise 62% to 74% of the total estimated construction cost. The implementation cost estimate based on the medium level soil remediation and disposal unit costs is summarized in Table 5.4. A detailed cost estimate based on a medium level cost on soil remediation and disposal is provided in Appendix C.

Table 5.4 - Alternative 4 Cost Estimate

Item	Cost Estimate
Construction	**$164,580,000**
Preliminary Engineering (2%)	$3,292,000
Soil/Groundwater Remediation Studies (3%)	$4,937,000
Environmental Review (2%)	$3,292,000
Final Engineering/Design (7%)	$11,521,000
Construction Management (5%)	$8,229,000
Environmental Monitoring (1%)	$1,646,000
Total	**$197,497,000**

5.6 ALTERNATIVE COMPARISON

5.6.1 Method

The method used to compare the alternatives was taken from the approach presented in River Projects and Conservation: A Manual for Holistic Appraisal (Gardiner, 1991). The method required the presence of all technical team members to participate in developing an evaluation matrix and contributing their knowledge to rank alternatives according to their area of expertise. The value of this approach was that each member of the team both contributed and listened to others contributing, thereby providing an opportunity to proactively resolve issues that overlap areas of expertise. Team members debated the issues to make a recommendation fully informed about the impacts of each alternative and the consequent comparisons that can be made between the alternatives.

A list of parameters relating to each alternative was developed and the parameters were then grouped under seven headings. The seven headings utilized were: Earthwork, Infrastructure, Contaminated Material, Water Sources, Landscaping, Ecological Function, and Regulatory Requirements. In general, the parameters were evaluated in a vertical manner covering all seven parameter categories for a given alternative before moving onto the next alternative.

Team members developed a color-coded, size delimited ranking system to quantitatively rank the absolute beneficial or adverse nature of the parameters. Green and red circles were used to identify the beneficial and adverse nature of the parameters, respectively. Three different sizes of circles were used to indicate the level of the beneficial or adverse nature of the parameters with larger sizes designating a higher level, either beneficial or adverse. Under this system, a large red circle represented a parameter with a high-level adverse nature, while a large green circle represented a parameter with a high-level beneficial nature. A medium-size, yellow circle was used to represent a parameter of neutral nature. This system was chosen over numerical ranking to avoid problems associated with parameter weighting and to provide a visual representation of the alternative evaluation process.

5.6.2 Results

The results of the alternative comparison evaluation for all four alternatives are presented in Table 5.5. The rationale used to evaluate each of the parameters is summarized below for each parameter category.

5.6.2.1 <u>Earthwork</u>

The ranking of the excavation and disposal parameters was related to the net volume of soil generated from alternative construction. Alternatives 1, 2, and 4 involve an extensive volume of excavation so these alternatives were ranked severely adverse from the standpoint of excavation and disposal. Implementation of Alternative 3 would involve a significantly lower volume of excavation so the excavation was ranked neutral. However, even though the net volume of excavated soil would be relatively small, disposal of over 650,000 cy of contaminated soil would still be considered adverse so it was ranked as low-level adverse.

Ranking of the grading requirements was based on the complexity of the topography required to achieve the target habitat distribution. Grading for all alternatives was considered adverse since grading for the purpose of riparian habitat creation is generally more difficult than grading for infrastructure creation or maintenance. The topographic variation required to implement Alternatives 2 and 3 will be more complex than that required to construct Alternatives 1 and 4, which is why the ranking for Alternatives 2 and 3 was considered more adverse.

5.6.2.2 <u>Infrastructure</u>

Implementation of Alternatives 1 and 2 would require construction of relatively complex water control structures to divert water from the LAR and nearby storm drains so this parameter

Table 5.5 - Alternative Comparison

was ranked as high-level adverse. Although removing the levee in Alternative 4 would not require construction of complex water control structures to divert water into the restored habitat areas, additional control structures (e.g., biotechnical bank stabilization, levee realignment) would probably be required to maintain the level of flood protection afforded by the existing infrastructure. Alternative 3 was ranked as high-level beneficial because the alternative would rely on direct precipitation and low amounts of local runoff for long-term sustainability.

From an infrastructure standpoint, Alternative 4 was ranked as high-level adverse because all site utilities, including the power transmission line towers, would have to be relocated to protect them from flood damage due to LAR storm flows. Alternatives 1 and 2 would require the same degree of utility protection or relocation; however, Alternative 2 was ranked slightly lower (mid-level adverse) due to the fact that utility maintenance would require improved management practices to minimize impacts to the diverse habitat created under Alternative 2. The level of impact for Alternative 3 was considered low-level beneficial since the minimal level of excavation probably would not require relocation of any utilities.

Alternatives 1 and 3 were deemed to have a neutral level impact on long-term maintenance access since the existing access roads can be left in place or restored in function following project completion. Alternatives 2 and 4 would have a high-level adverse impact. Implementation of Alternative 1 would limit maintenance access during storms in the wet season since the habitat area would be used to provide flood flow storage. Access would have to be limited for implementation of Alternative 3 to minimize disturbances to the sensitive upland plant communities that would be targeted for this alternative.

Since Alternatives 1, 2, and 4 provide some degree of flood storage, all three alternatives were ranked as beneficial impacts with the level directly proportional to the degree of excavation and connection to the LAR. Alternative 1 was ranked as high-level and Alternative 2 was ranked as low-level with Alternative 4 in the middle as a mid-level beneficial impact. A neutral level impact was assigned to Alternative 3 since there is no flood storage improvement under that alternative.

5.6.2.3 Soil and Groundwater Contamination

The feasibility of on-site treatment and associated cost was ranked as high-level adverse for Alternatives 1 and 4 due to the relatively large net volume of excavated soil and the corresponding area of land required to stage the on-site treatment operations. Alternative 3 was ranked as low-level adverse since the net volume of excavated soil would be relatively small compared to the other alternatives. Alternative 2 was ranked as mid-level adverse due to the relatively small net excavation volume and area required for on-site treatment operations. The overall feasibility of on-site treatment was deemed to be adverse because on-site treatment of the lowest volume of soil associated with alternative implementation (i.e., Alternative 3) would still require a substantial amount of effort and time.

The feasibility of off-site treatment was ranked as mid-level adverse for Alternatives 1 and 4 due to the relatively large net volume of excavated soil. Alternatives 2 and 3 were ranked as low-level beneficial since the net volume of excavated soil would be relatively small. The cost of off-site treatment was directly proportional to the net volume of excavated soil with

Alternatives 1 and 4 ranked high-level adverse and Alternative 3 ranked as low-level adverse. Alternative 2 was ranked as mid-level adverse because the net excavation volume associated with construction is between Alternatives 1 and 3.

Based on the historical fluctuation in groundwater levels, the excavation associated with Alternatives 1 and 4 would expose the groundwater to surface soils and wildlife. For this reason, the impact of these alternatives on groundwater was ranked as high-level adverse. The impact of Alternative 2 on groundwater was ranked as mid-level adverse because the proposed bottom elevation of the restored habitat and flood storage area would be above the historical high elevation of groundwater in that area. In addition, the wildlife that is expected to use the habitat created under Alternatives 1, 2, and 4 could impact the exposed groundwater through introduction of new pathogens to the system (e.g., fecal coliforms). The bottom elevation associated with Alternative 3 would be located substantially above the historical high elevation of groundwater in the area. In addition, implementation of Alternative 3 features an impermeable liner to isolate surface flows and groundwater flows; therefore, the impact of Alternative 3 on groundwater was ranked as neutral.

5.6.2.4 Water Sources

Using the LAR to maintain habitat under Alternative 1 was ranked as low-level adverse due to the difficulties associated with the required diversion structure (structural design, energy loss, erosion protection, hydraulic jump formation). The water needs of the habitat distribution associated with Alternative 2 and the lower bottom elevation would require a much smaller diversion structure, which is why Alternative 2 was ranked as low-level beneficial. Alternative 4 would rely principally on LAR flows to maintain the target habitat distribution so the impacts associated with this alternative were considered high-level beneficial. Since Alternative 3 would not feature any changes to the river channel it was ranked neutral in terms of impacts to the LAR.

Local storm water runoff could be used for all four alternatives with various levels of impacts. The impact of using storm water runoff for Alternatives 1 and 2 was deemed to be mid-level beneficial because there would be sufficient volume to contain the runoff and treatment measures (e.g., treatment wetlands) could be constructed to improve the water quality. The use of storm water runoff was determined to be low-level adverse for Alternative 3 because the volume of runoff would easily overrun the shallow upland areas, thereby impacting the target habitat and the water would have to be pumped for use. Under Alternative 4 storm water runoff would not be needed as a source of water and there would not be any area available for treatment wetlands so the impact with storm water runoff under this alternative was ranked neutral.

Effluent from the Glendale Treatment Plant could be pumped via pipeline to Taylor Yard under all four alternatives to be used as a source of water for habitat restoration. Reuse of wastewater effluent in this manner was ranked as low-level beneficial. It would have been ranked high-level beneficial except that it would be relatively expensive to construct and maintain the infrastructure (pumps and pipes) necessary to utilize the water source.

The impacts of using groundwater as a source of water under Alternatives 1 and 2 were deemed to be mid-level adverse due to regulatory issues associated with mixing groundwater and surface water of different quality. In addition, the quality of the groundwater may threaten the target wildlife of the restored habitat under these two alternatives. Relatively expensive treatment facilities could be constructed to lower contamination to acceptable levels prior to discharge into the LAR. The impact was ranked high-level adverse for Alternative 4 because the groundwater would be in direct contact with LAR flows without any opportunities for pretreatment prior to release into the LAR. Under Alternative 3 small volumes of groundwater could be pumped and treated for use in maintaining the upland habitat, therefore groundwater use was ranked as low-level beneficial.

It would be difficult to hydraulically isolate groundwater and surface water under Alternatives 1 and 4 due to potential impacts to groundwater flow and design problems associated with the anticipated hydrostatic pressures. The construction of an impermeable liner would modify the existing groundwater flow pattern under Taylor Yard, which could modify distribution of the contaminant plume underlying the site. The hydrostatic pressure under the liner would tend to make it float so it would have to be anchored in some way or a drainage system would have to be constructed to relieve the pressure. Alternative 2 was ranked mid-level adverse since the bottom elevation is higher and, consequently, a liner would have less impact on groundwater flow and there would be less hydrostatic pressure on the liner. Under Alternative 3 the bottom elevation would be substantially higher than the historical high groundwater elevation in the area so liner construction would not impact groundwater flow patterns or require additional design measures to address hydrostatic pressure. Therefore, the impact of hydraulically isolating groundwater and surface water under Alternative 3 was deemed to be high-level beneficial.

5.6.2.5 Landscape Treatment and Human Use

Under Alternative 1 public access to Parcels G and D would have to be managed during the wet season for safety reasons. The site would be gated and fenced with the gate closed during periods of potential storm activity. For this reason, the impact to public access under Alternative 1 was ranked low-level adverse. Access to Parcel G under Alternatives 2 and 4 would be fairly unrestricted for those areas above water so these alternatives were ranked as neutral. Since the public would have full access to all of Parcel G under Alternative 3 it was ranked as mid-level beneficial.

Alternative 4 provides a high-level beneficial impact to the public's access to view the river since the public would have direct access to the river's edge. Alternatives 1 and 3 would allow access to view the river from trails and overlooks so the impact for these alternatives was ranked mid-level beneficial and low-level beneficial, respectively. Alternative 2 would require a more intensive level of management to limit human activity in sensitive areas, thereby limiting access to designated points for viewing the river, therefore the impact to river views was ranked neutral to low-level adverse for this alternative.

The increased level of management required to optimize habitat diversity under Alternative 2 would limit human activity, thereby maximizing the amount of non-public wildlife area. Alternatives 1 and 4 also would provide some level of protection to various habitat areas from human activities. For these reasons, the ability to provide non-public wildlife areas was ranked low-level beneficial, high-level beneficial, and mid-level beneficial under Alternatives 1, 2, and 4, respectively.

The complexity of the planting plan under each alternative was ranked according to the diversity of the target vegetation and the difficulty to establish the vegetation. Alternatives 2 and 3 were ranked as high-level adverse and low-level adverse, respectively due to the relatively complex habitat distributions. Since Alternative 1 would consist of a fairly uniform plant palette of easily established species, it was ranked as low-level beneficial. Alternative 4 was ranked as neutral because the habitat would be allowed to establish itself along the restored riverbank with limited planting.

The plant palette for Alternative 1 should be fairly inexpensive to establish so the cost was ranked low-level beneficial. On the other hand, the other three alternatives would cost substantially more to establish than Alternative 1 so the cost for these alternatives was ranked low-level adverse for Alternative 4 and mid-level adverse for Alternatives 2 and 3. Most of plant species for Alternative 3 would have to be planted individually by hand, which would tend to increase the costs. Although the planting plan for Alternative 4 would not be complex the biotechnical bank stabilization required along the fringe would increase the planting costs.

The almost homogenous planting palette for Alternative 1 would require very little short term maintenance so this alternative was ranked as neutral, while the other three alternatives were ranked as low-level adverse. Alternatives 2 and 3 were ranked as low-level adverse primarily due to the exotic species control effort required to establish the complex planting palettes. Alternative 4 was ranked as low-level adverse because of the expected maintenance required to replace plants lost to storm flows in the LAR.

The irrigation demand of each alternative was evaluated with Alternatives 1 and 4 requiring the least irrigation because the plants would be nourished primarily by LAR flows. Alternative 3 would have the highest level of irrigation demand since the only source of water would be precipitation and a small volume of local runoff in the dry season. The upper slope plant species under Alternative 2 would have a relatively high level of irrigation demand until the plant community becomes established. Therefore, Alternatives 1 and 4 were ranked as neutral while Alternatives 2 and 3 were ranked as low-level and mid-level adverse, respectively.

5.6.2.6 Ecological Function

Since restoration of riparian and related habitat was a primary objective of the restoration component of the multi-objective study, the alternatives were ranked based on the connectivity to the LAR. Alternatives 1, 2, and 4 were ranked as beneficial because all three alternatives involve some connection to the LAR. Alternative 4 was ranked high-level beneficial since the alternative would feature levee removal/relocation and floodplain restoration. Alternatives 1 and 2 were ranked mid-level beneficial and low-level beneficial, respectively based on the degree of river connection associated with each alternative. Alternative 3 was ranked low-level adverse because it would not feature any hydraulic connection with the LAR or riparian-related habitat.

Alternatives 1, 2, and 4 were ranked high-level beneficial for the ability to provide riparian thicket habitat. Due to the limited water source and creation of upland habitat associated with Alternative 3, it was ranked low-level beneficial for its ability to provide riparian thicket habitat, though other associated habitats were being provided, thereby avoiding an adverse rating.

Alternatives 1 and 2 were ranked high-level beneficial for the ability to provide wetland habitat. Alternative 4 was ranked as low-level beneficial because a substantial portion of the habitat would be river/open water, a habitat that is relatively common. Alternative 4 would also be ranked high-level beneficial since some of the habitat types would be considered as wetland habitat. Due to the limited water source and creation of upland habitat associated with Alternative 3, it was ranked neutral for its ability to provide wetland habitat.

All the alternatives provide good opportunities to create grassland/scrub habitat so all four alternatives were ranked as beneficial. Based on the proposed planting palette, Alternative 2 provides the greatest area of grassland/scrub habitat so it was ranked high-level beneficial, while Alternative 1 was ranked low-level beneficial since it provides the lowest area of grassland/scrub habitat. Alternatives 3 and 4 provide equal opportunities for grassland/scrub habitat so both were ranked mid-level beneficial.

All the alternatives provide good opportunities to create upland habitat so all four alternatives were ranked as beneficial. Based on the proposed planting palette, Alternative 3 provides the greatest area of upland habitat so it was ranked high-level beneficial. Alternatives 1, 2, and 4 were all ranked low-level beneficial since all three alternatives provide similar levels of and opportunities for upland habitat.

Each alternative was evaluated for its ability to be sustainable in the future with minimal intervention by humans. Alternatives 3 and 4 were designed to replicate natural habitat functions so these alternatives should be the most sustainable and, hence, these alternatives were ranked high-level beneficial. Exotic species control and target species management would require significant effort for Alternatives 1 and 2. *Arundo* control under Alternative 1 would be a significant problem affecting long-term sustainability so this alternative was ranked low-level adverse. Maintaining the target species distribution for Alternative 2, as well as exotic species control, would probably require more management so this alternative was ranked mid-level adverse.

5.6.2.7 Regulatory Requirements

The alternatives were evaluated from a regulatory standpoint to estimate the degree of difficulty in obtaining permits to implement the desired components of each alternative. Alternatives 1 and 2 were ranked high-level adverse across the board for all likely permit requirements and water use issues. This is because implementation of these alternatives would involve exposing contaminated groundwater, discharging potentially contaminated storm water into the LAR, exposing wildlife to contaminated groundwater and sediment, airborne exposure of contaminated soil during construction, and significant modifications to surface water and groundwater flow patterns.

Since only direct precipitation and small volumes of local runoff would maintain the target habitat, Alternative 3 would have the least regulatory requirements. The alternative was ranked low-level adverse with the DTSC due to the cleanup requirements associated with excavation of the contaminated soil. Alternative 3 was also ranked low-level adverse with South Coast Air Quality Management District (AQMD) and ULARA due to air quality construction impacts (airborne suspension of contaminated soil) and water use issues, respectively. The alternative was ranked high-level beneficial with the LARWQCB since the low volume of local runoff would be treated prior to discharge back to the LAR or infiltration back into the groundwater aquifer. Since most storm runoff would be unaffected under Alternative 3, the impact related to NPDES was ranked neutral to low-level beneficial.

Implementation of Alternative 4 was ranked high-level adverse from the regulatory standpoint of DTSC and AQMD based on the relatively large volume of contaminated soil that would be excavated and due to exposure of contaminated soil and groundwater. Based on modifications to the existing surface water and groundwater flow patterns resulting from level removal/relocation, Alternative 4 was ranked low-level adverse with the LA-RWQCB and mid-level adverse with the ULARA. Since storm runoff would drain directly to the LAR under Alternative 4, the impact related to NPDES was ranked neutral.

Alternatives 1, 2, and 4 would most likely require a Section 404 permit for potential impacts to Waters of the United States associated with hydraulic connection to the LAR. A Streambed Alteration Agreement from the California Department of Fish and Game would probably be needed for changes within (Alternative 4) the LAR channel and, possibly, for changes to the flow regime (Alternatives 1 and 2). Consultation and coordination with the various resource agencies (e.g., U.S. Fish and Wildlife Service) would likely be required during the permitting process for the Section 404 and Streambed Alteration Agreement.

5.6.3 Discussion

Comparing the results of the evaluation described above across all alternatives it is clear that Alternative 3 provides the best balance between beneficial and adverse impacts. There is an almost equal number of adverse (red) and beneficial (green) responses in the matrix with several neutral responses. This result seems reasonable given that the objective of Alternative 3 was to maximize upland habitat and minimize impacts related to excavation that would be required to provide any flood storage improvement.

A more detailed inspection of Table 5.5 reveals two significant points that are not so obvious. The first point, Alternative 4 provides the highest level of beneficial impact as seen under Infrastructure (Flood Protection), Water Sources, Landscape and Human Use, and Ecological Function. Basically, Alternative 4 provides the highest level of beneficial impacts and causes the highest level of adverse impacts.

The other point that can be seen on the matrix is that comparison of the results for Alternatives 2 and 3 suggests the possibility that a hybrid alternative could be developed to balance the beneficial and adverse impacts associated with these two alternatives. The hybrid alternative would feature a level of excavation, habitat distribution, and water source mixture that is somewhere between Alternatives 2 and 3.

6. CONCLUSIONS

Historical railroad operations and offsite industrial/commercial activities have steadily degraded the environmental health of the Taylor Yard site. The surface habitat across most of the site was completely removed in the past although some areas have recovered since the removal of the railroad facilities. Years of railroad maintenance operations and adjacent industrial/commercial uses have contaminated the soil and contributed to groundwater contamination beneath the site to such a degree that the site is within an area designated as a State Superfund site for groundwater contamination. This situation also has had a negative impact on the surrounding residential areas, acting as a health and safety barrier for harmonious development of the urban fabric and limiting incorporation of the LAR as an important component to the urban landscape. Past habitat degradation, current operations, and contamination have virtually eliminated wildlife usage of the site. In short, Taylor Yard constitutes a blighted urban area and it is in poor condition from a recreational, environmental, and ecological standpoint.

The results of past and ongoing testing programs indicated that the soil and groundwater beneath Taylor Yard are contaminated with various chemicals of potential concern related primarily to past railroad maintenance operations as well as offsite land uses. Most of the contaminants were found at levels below threshold concentrations; however, several contaminants were found at levels significantly higher than the threshold concentrations. The results of the ongoing contaminant investigation (RI/FS) being conducted for Parcel G will be used to determine remediation responsibilities and cleanup levels for onsite contamination to reduce the risk of potential toxicity to humans to acceptable levels. Some remediation (e.g., soil vapor extraction of VOCs) of contaminants is already underway to remove existing soil contamination, thereby reducing potential sources of groundwater contamination. The DTSC is overseeing these cleanup measures as well as the ongoing contaminant investigations being performed by the UPRC.

The purpose of the soil and groundwater testing conducted during the past several years at Taylor Yard was to determine the cleanup responsibilities and remediation requirements necessary to allow the site to be utilized for industrial, commercial, and residential land uses. Testing and analyses have not been performed to determine the remediation requirements necessary to allow the site to be utilized for habitat restoration. Many wildlife organisms are more sensitive to certain contaminants than humans primarily because the organisms are exposed to the contaminants for longer periods of time since they reside in the soil and groundwater. Some contaminants can bioaccumulate in organisms near the top of the food chain; thereby, magnifying the effects of small contaminant concentrations in organisms near the bottom of the food chain. Since the studies conducted to date at Taylor Yard have not tested for these contaminants, it is not possible to evaluate the severity of potential toxicity to the wildlife that would utilize the Taylor Yard site after restoration.

The management of the water in the ULARA is a complicated maze of regulations, agencies, and legal judgments. Any project at Taylor Yard that would potentially impact the quantity or quality of the water (surface water or groundwater) would have to be coordinated with the

ULARA Watermaster's office, LADWP, and LARWQCB. Any water returned to the municipal water supply for potable or irrigation purposes would have to meet stringent requirements set by the DHS. The USACE and LACDPW are responsible for regulating activities that would potentially impact the level of flood protection currently provided by the LAR flood control system. The contaminated nature of the existing soil and groundwater makes it more difficult to navigate this complex maze due to redistribution of contaminated water or contamination of "clean" water. In a very real sense, project complexity related to water issues increases with increasing excavation depth and connection to existing water delivery systems (i.e., LAR flows, local runoff flows, groundwater, irrigation supply, drinking supply).

The various constraints and opportunities were addressed through development of four project alternatives. Since it was not possible to develop one alternative that met all objectives, a matrix of potential multi-objective projects was developed with each alternative focused primarily on one or two objectives. Alternative 1 was focused on optimizing flood storage for the LAR while providing limited recreational and habitat benefits. The primary objective of Alternative 2 was to optimize habitat diversity while providing recreational and flood storage benefits. Alternative 3 was developed to optimize upland habitat while minimizing excavation and water-related issues. The primary objective of Alternative 4 was to restore a portion of the historical floodplain through removal/relocation of the existing flood control levee, thereby providing riparian wetlands and fringe habitat, along with limited recreational benefits.

During the 100-year flood event, the results of the hydrodynamic modeling analysis indicated that the LAR would be in a mixed flow regime along the upstream vicinity of the project site under Alternatives 1 and 2. The mixed flow regime might significantly increase the difficulty of designing a structure to divert flood flows from the LAR into an excavated basin within the Taylor Yard site. In addition, the results of the modeling study indicated that high velocities (10 fps to 20 fps) would characterize the diversion structure region, therefore, significant energy dissipation and slope stabilization measures would probably be needed for implementation of Alternative 1 and, possibly Alternative 2.

The results of the hydrodynamic modeling analysis indicated that implementation of a flood storage improvement program consisting of floodplain restoration along the LAR could improve flood storage, restore riparian habitats, and increase recreational facilities. The analysis involved simulating 100-year flood flows in the LAR with nine restoration projects identical to Alternative 1 implemented along the LAR at various locations. This was a first-order analysis, with no attempt to optimize the restoration site locations, restoration project plan, or diversion structure design, so further studies might reveal that additional benefits could be achieved through this type of study. These results suggest that the USACE and LACDPW should consider the development of a comprehensive, phased floodplain restoration project implemented over several years or decades.

The restoration of riparian wetlands habitat, increase in flood storage, and creation of recreational facilities will require the excavation, remediation, transportation, and disposal of relatively large volumes of contaminated soil. Construction of Alternative 1, Alternative 2, Alternative 3, and Alternative 4 will involve earthwork and remediation for 2.7 million cy, 1.0 million cy, 0.6 million cy, and 1.3 million cy of soil, respectively. The estimated costs to implement Alternative 1, Alternative 2, Alternative 3, and Alternative 4 are shown in Table

6.1. The different cost levels are based on low to high ranges of soil remediation and disposal costs, based on currently available site data.

Table 6.1 - Implementation Cost Comparison

	Cost in Million $		
	Low	**Medium**	**High**
Alternative 1	198	338	658
Alternative 2	79	132	254
Alternative 3	61	95	173
Alternative 4	126	197	360

These ranges in cost estimates should not be viewed as a worst-case or overly conservative estimate. This is because additional contaminant investigations focused on ecological toxicity might reveal that more stringent cleanup requirements will be needed to allow habitat restoration on the soil remaining on Taylor Yard.

The potential availability of a large piece of open space adjacent to the LAR provides a rare opportunity to return historical floodplain to public ownership so it is available to current and future generations for habitat restoration, flood storage, and recreation. Habitat restoration and flood storage improvement at Taylor Yard will ultimately require a relatively large expenditure of funds due to the large volume of contaminated soil, water rights issues, contaminated groundwater, and hydrologic/hydraulic constraints. In addition, project implementation will involve a long-term commitment to get through the lengthy planning, permitting, and design effort that will be required to achieve restoration of the LAR. The fact that it will be difficult and expensive to restore Taylor Yard is an indication of how much environmental damage has taken place historically at the site. It took numerous activities conducted over 100 years for Taylor Yard to reach its current condition; therefore, it is reasonable to assume that restoration will involve a long-term program with public ownership as the first goal. Finally, Taylor Yard should be viewed as the first of many opportunities to enhance and restore the LAR environment for the benefit of present and future generations.

7. RECOMMENDATIONS

Although any one of the four alternatives presented in Chapter 4.0 could be pursued for future implementation, the project team recommends that the SCC should move forward with implementation of Alternative 3. Alternative 3 strikes the best balance between site opportunities and constraints, acknowledging the aim of achieving a multi-objective project that will provide habitat restoration and create recreational facilities within Taylor Yard. Adoption of Alternative 3 does not exclude the other alternatives in the longer term, but requires the least expenditure in the short term. While this approach does not provide for immediate flood storage improvement, this goal could be pursued through implementation of Alternative 1, 2, or 4 in the future. The primary reasons the Team selected Alternative 3 are summarized below.

1. First and foremost, the project would place the property in public ownership, therefore creating the opportunity to increase the total area of wildlife habitat and open space in the Los Angeles Basin. Placing the land in public ownership will give people a place to recreate and commune with nature, while giving future generations the opportunity to reconfigure Taylor Yard to meet the wildlife and recreational needs at a future time.
2. Alternative 3 is the least expensive alternative and it provides the lowest cost per acre of restored habitat. Assuming the upland/ riparian fringe and riparian wetlands habitats have equal value, Alternative 3 is the most cost-effective alternative for achieving the same habitat value. Given the scarcity of upland/ riparian fringe habitat within the lowland Los Angeles Basin, it could be argued that this habitat is more valuable.
3. Project construction would provide future opportunities for riparian wetland restoration after remediation of contaminated groundwater to acceptable levels.
4. Future floodplain restoration and flood storage improvement activities could be undertaken on the site after remediation of contaminated groundwater.
5. The relatively small volume of excavated soil minimizes the ecological risk associated with exposure of contaminated soil during construction.
6. The relatively high excavation elevation minimizes the ecological risk associated with contaminated groundwater that is located at deeper elevations below the site.
7. The location of the proposed wildlife viewing platform, close to Parcel D, would facilitate the integration between active and passive recreation areas.
8. Inclusion of an access road on the west corner of Parcel D would facilitate the connection of the passive recreation area with San Fernando Road and would allow the possible future connection of neighborhoods on both sides of the LAR via a pedestrian bridge across the river.

There are still many issues that need to be addressed before environmental review, permitting, final design, and construction can begin. Future planning and design studies should be conducted in close coordination with studies undertaken for Parcel D to make sure recreational facilities are properly integrated from the standpoint of human use and wildlife impacts. It may be possible to lower environmental review and construction costs by combining individual projects on Parcel G and Parcel D into one project. The major steps required for project implementation are summarized below.

1. Identify funding sources for all phases of project implementation, which include preliminary engineering, soil remediation (RI/FS), environmental review, land acquisition, permitting, construction, maintenance, and long-term monitoring.
2. Complete the human health risk assessment to develop a remedial action plan for soil clean up from the standpoint of human health and perform an ecological risk assessment to determine the level of soil remediation required for habitat restoration. The results of the ecological risk assessment also would be used to provide design criteria (e.g., excavation depth and/or liner requirements) to minimize potential ecological toxicity associated with exposure to contaminated groundwater.
3. Establish agreements for the soil remediation responsibility of the current landowner based on ultimate land uses of habitat restoration and flood storage improvement.
4. Implement a community involvement program to develop the best array of active park and passive recreation uses on Parcel D and identify the optimal mix of regional (e.g., LAR Bike Trail) and local connections (e.g., Park Nature Trail).
5. Conduct a preliminary engineering study to develop and analyze construction methods, soil remediation techniques, soil disposal options, and utility protection/realignment in more detail. The study would include the development of several upland habitat restoration options to provide a range of different habitat mixes, excavation/disposal requirements, and recreation facilities (e.g., nature center and trails). In addition, detailed phasing plans would be developed for future site activities and the feasibility of combining projects on Parcel D and Parcel G into one project would be analyzed as part of this study.
6. Investigate the feasibility of using a portion of the upland restoration site for treatment of local runoff and subsequent discharge of the treated water into the LAR.

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9. APPENDICES

APPENDIX A: SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

APPENDIX B: ONE-DIMENSIONAL HYDRODYNAMIC MODELING STUDY

APPENDIX C: DETAILED IMPLEMENTATION COST ESTIMATES